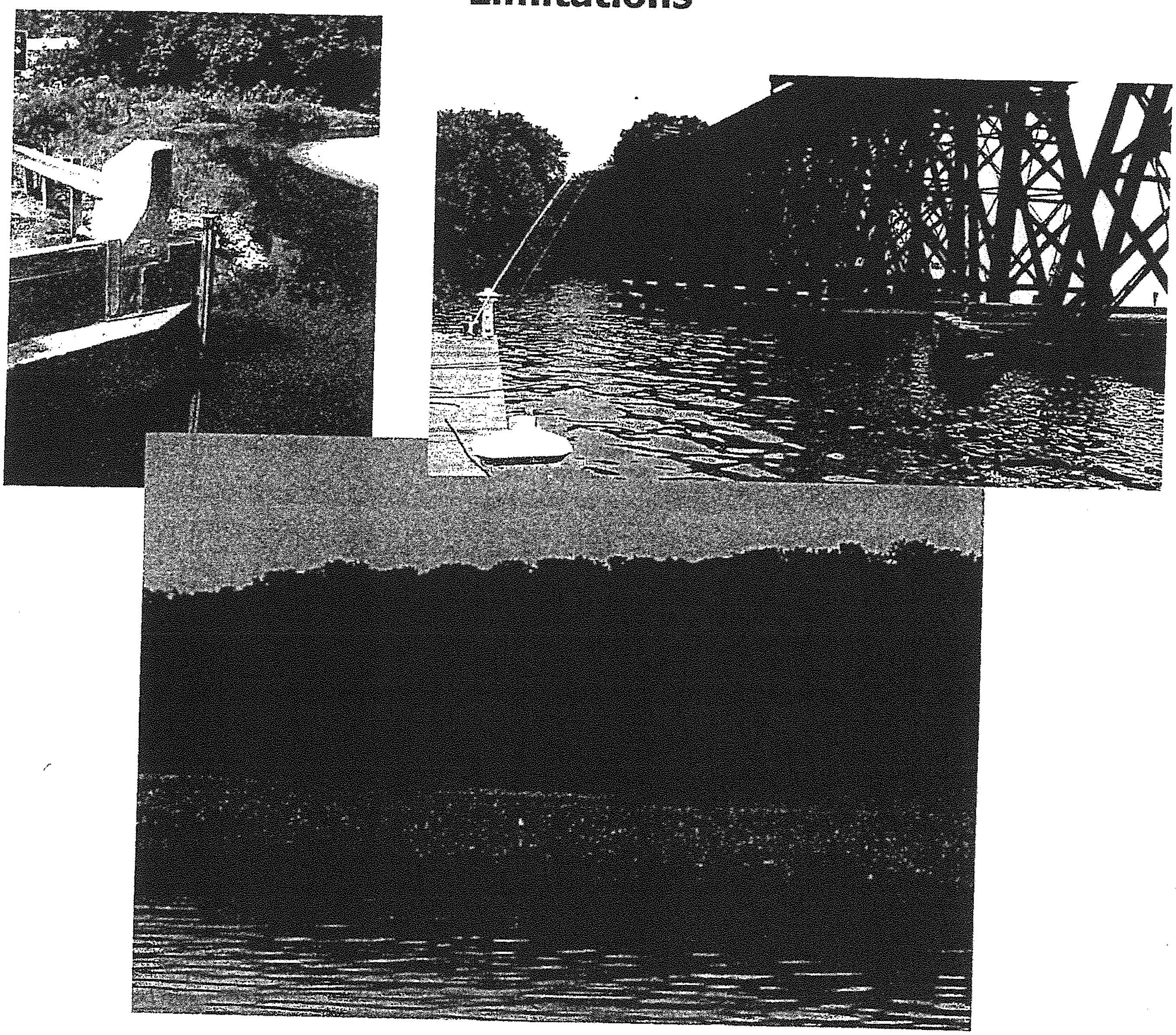
Prince William County Service Authority
H.L. Mooney Water Reclamation Facility

VPDES Permit No. VA0025101

In-Stream Monitoring Report For the Evaluation of Ammonia Effluent Limitations



GREELEY AND HANSEN

Attachment 8

Prince William County Service Authority
H.L. Mooney Water Reclamation Facility
VPDES Permit No. VA0025101

In-Stream Monitoring Report
For the Evaluation of Ammonia Effluent Limitations

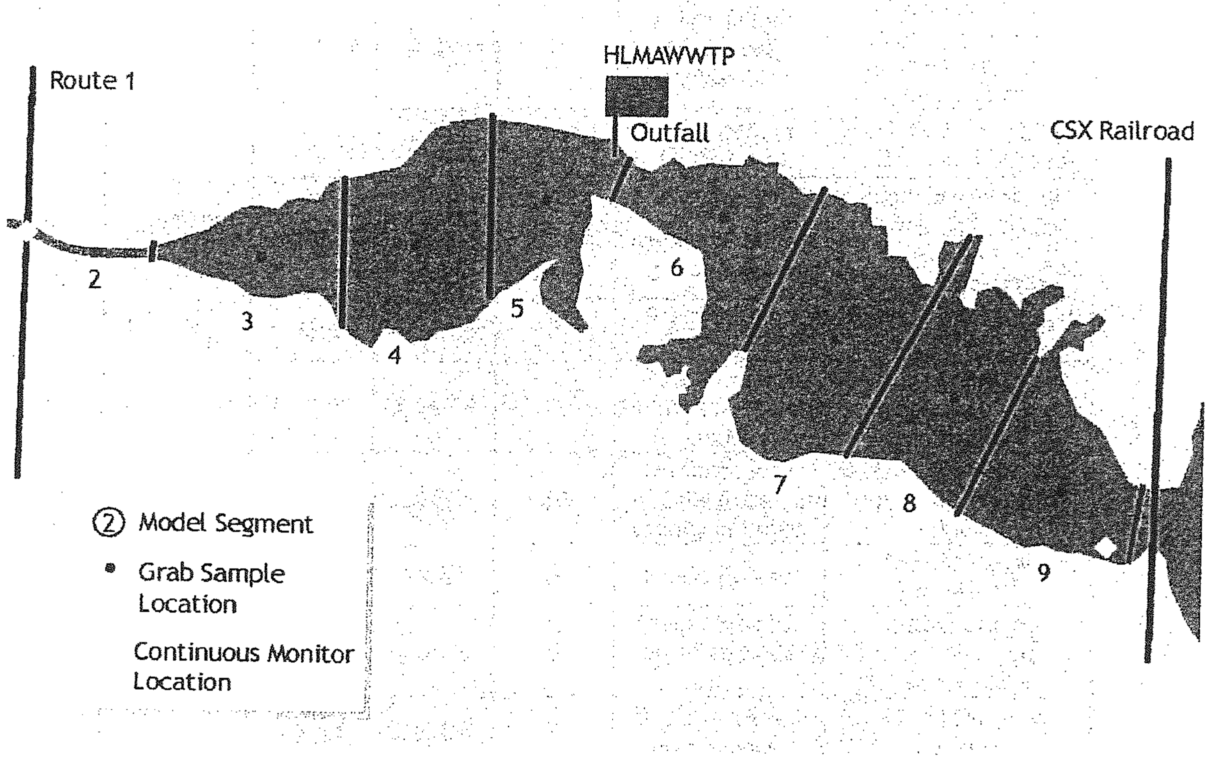
Greeley and Hansen LLC
December 1, 2005

1.0 Introduction

The Prince William County Service Authority (Service Authority) owns and operates the H.L. Mooney Water Reclamation Facility (Mooney WRF, plant). The plant discharges treated effluent to Neabsco Creek, a tributary of the Potomac River. On October 15, 2003, the Virginia Department of Environmental Quality (VDEQ) reissued the VPDES Permit for the Mooney WRF (2003 permit). The 2003 permit includes effluent limitations for ammonia based on a limited data set from grab samples taken sporadically over a period of several years. Part I.E.11 of the permit calls for instream monitoring for temperature and pH in Neabsco Creek to confirm the 2003 ammonia limits. Previously, the Service Authority utilized the Neabsco Creek Embayment Model developed by the Virginia Institute of Marine Science (VIMS model) to assist in the development of permit limits; this model was updated and used again for this analysis.

As called for in the VPDES Permit, the Service Authority has conducted the in-stream monitoring study to assist in determining waste load allocations for Neabsco Creek and discharge limits for the Mooney WRF. The instream sampling plan consists of taking twice-monthly grab samples from eight segments matching those of the VIMS model. Four of the segments are upstream of the plant, representing water quality before the Mooney WRF, and four locations are downstream of the plant, representing water quality after the addition of the Mooney WRF effluent. These sampling locations are shown in Figure 1. GPS was used to assure grab samples were taken in the same locations throughout the sampling program. In addition to the biweekly grab-samples, the approved sampling plan called for two continuous monitors to be installed in Neabsco Creek. One located at the Route 1 Bridge upstream of the plant (upstream probe) and one at the CSX Railroad Bridge near the confluence of Neabsco Creek with Neabsco Bay and the Potomac River (downstream probe). After extensive negotiations with CSX and an adjacent marina, the location of the downstream probe was changed from the CSX Bridge to a marina pier as discussed in the *Preliminary Monitoring Report* issued to VDEQ in April 2005. The Instream monitoring was originally scheduled to begin in June 15, 2004 and end February 15, 2005. However, due to the extensive negotiations concerning locations of the probes and other complications, this sampling period was adjusted to November 17, 2004 though September 30, 2005 with VDEQ consent.

Figure 1: Neabsco Creek Sampling Locations



2.0 Sampling Results

During the sampling period gaps and anomalies in the data and sampling procedures were noted and corrective action was taken. Data were recorded, tracked and graphed and efforts were made to understand and explain unexpected results. These are discussed below.

2.1 Sampling Anomalies

During any extended sampling period anomalies and gaps in data due to equipment outages, weather or other uncontrollable events are to be expected. Several such events were experienced during this sampling program and are outlined below. As problems arose, solutions were developed which aimed to prevent a repetition of the same problem. Table 1 below provides a summary of the sampling anomalies that were experienced during this project. The table shows anomalies and gaps in the continuous monitoring probes that lasted for at least one calendar day. There were gaps in the data which last less than one day, these smaller gaps typically represent the times that the probes' data were being downloaded or during which routine maintenance was being performed.

Table 1– Sampling Gaps in Continuous Monitoring Probes

Probe	Start Date	End Date	Days	Reason for Problem	Solution
Upstream	11/20/04	11/30/04	11	Probe failure during long deployment	Decrease interval between probe maintenance and calibration
	1/22/05	2/16/05	26	Probe Failure: no readings	Purchased new probe + 2 backup probes
	3/18/05	3/30/05	13	Flooding upstream caused probe failure	Wait for waters to recede and replace probe - Data Discarded
	4/6/05	4/12/05	7	Programming Error	Reprogrammed and redeployed
	4/13/05	4/18/05	6	Power Failure: Premature battery failure	Start changing batteries on a regular schedule
Downstream	12/3/04	12/28/04	26	Neabsco was partially frozen in vicinity of probe	Ultimately probe was moved from post to dock
	3/31/05	4/4/05	5	Probe Failure	Maintenance Performed
	4/9/05	4/14/05	6	Power Failure: Premature battery failure	Start changing batteries on a regular schedule
	8/10/05	8/16/05	7	Probe Failure: no readings	Replaced Probe with backup

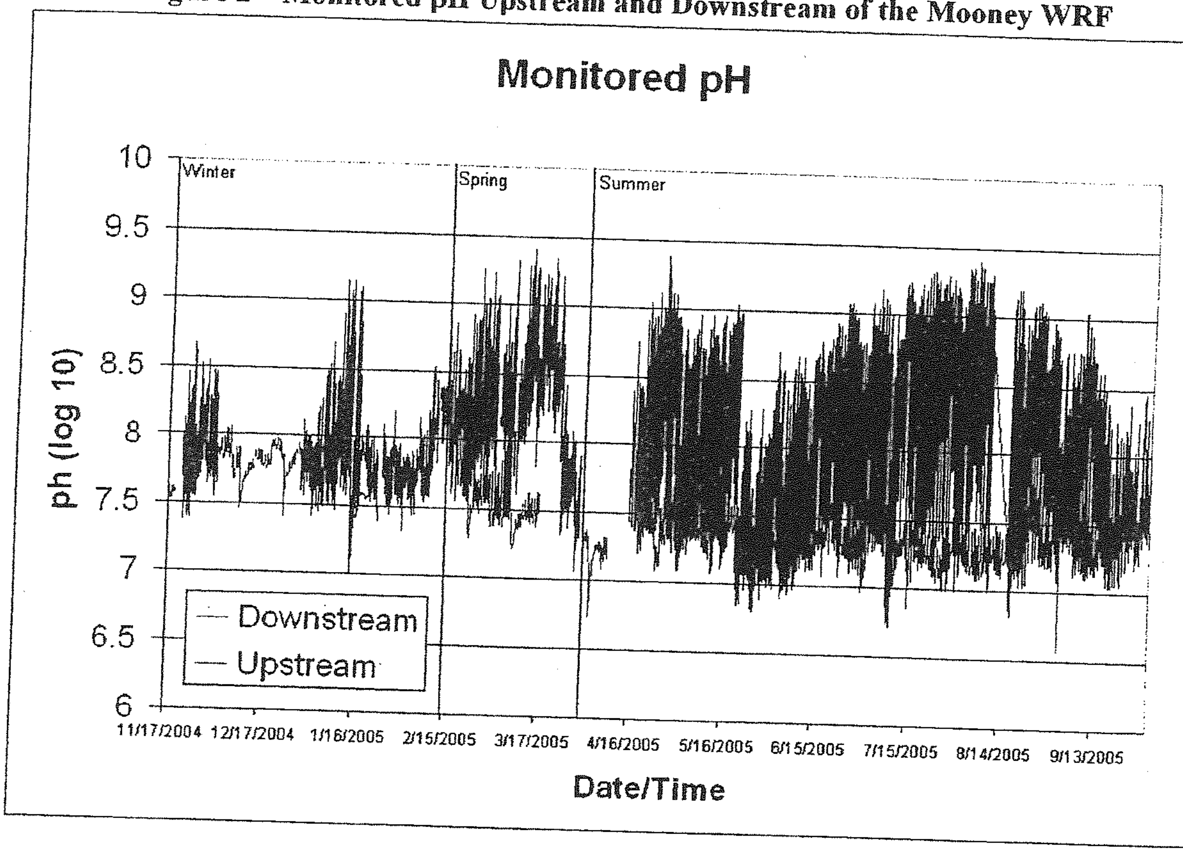
Anomalies or gaps in the data were also present in the grab samples; these typically were a result of access issues to a specific stream-segment. There were times when due to frozen conditions, low tide or very extensive vegetation not all segments could be sampled. The impact of these data gaps is minimal due to the other data that were collected.

The final anomaly that requires discussion is one of sampling time steps. As with all continuous meters these were not truly "continuous" but rather took readings at a prescribed time step. The most common time step throughout the sampling period was one hour, however there are periods during which data were collected at three minute, thirty minute and two hour intervals. During the data analysis it was necessary to have a uniform time step throughout the data record so that averages and percentiles could be calculated correctly. The data were normalized to a two-hour time step (the largest time step). This was done by removing data from time steps that were smaller than two hours; for instance if 30-minute readings were taken at 12:00, 12:30, 1:00, 1:30, and 2:00 then only the reading from 12:00 and 2:00 were used for the analysis. The removal of data was based strictly on the time it was taken, not on the values of pH or temperature recorded during the step.

2.2 pH Results

The pH was monitored upstream and downstream of the plant using continuous monitoring probes as described above. The results of this monitoring are shown in Figure 2 below. The pH was found to be highly variable at the downstream location, where Neabsco Creek meets the Potomac River. It was not uncommon to see pH swings of greater than one standard unit in a single day. An analysis was conducted correlating the pH with the tides and it was found that the high pH readings were coming in from the Potomac River rather then out from Neabsco Creek. In order words, the high pH readings were seen during or just after a high tide. This correlation was seen in other area waterbodies upstream and downstream of Neabsco Creek on the Potomac River. Relatively stable pH values were recorded in the upstream portion of Neabsco Creek which has a much lower tidal influence.

Figure 2 – Monitored pH Upstream and Downstream of the Mooney WRF

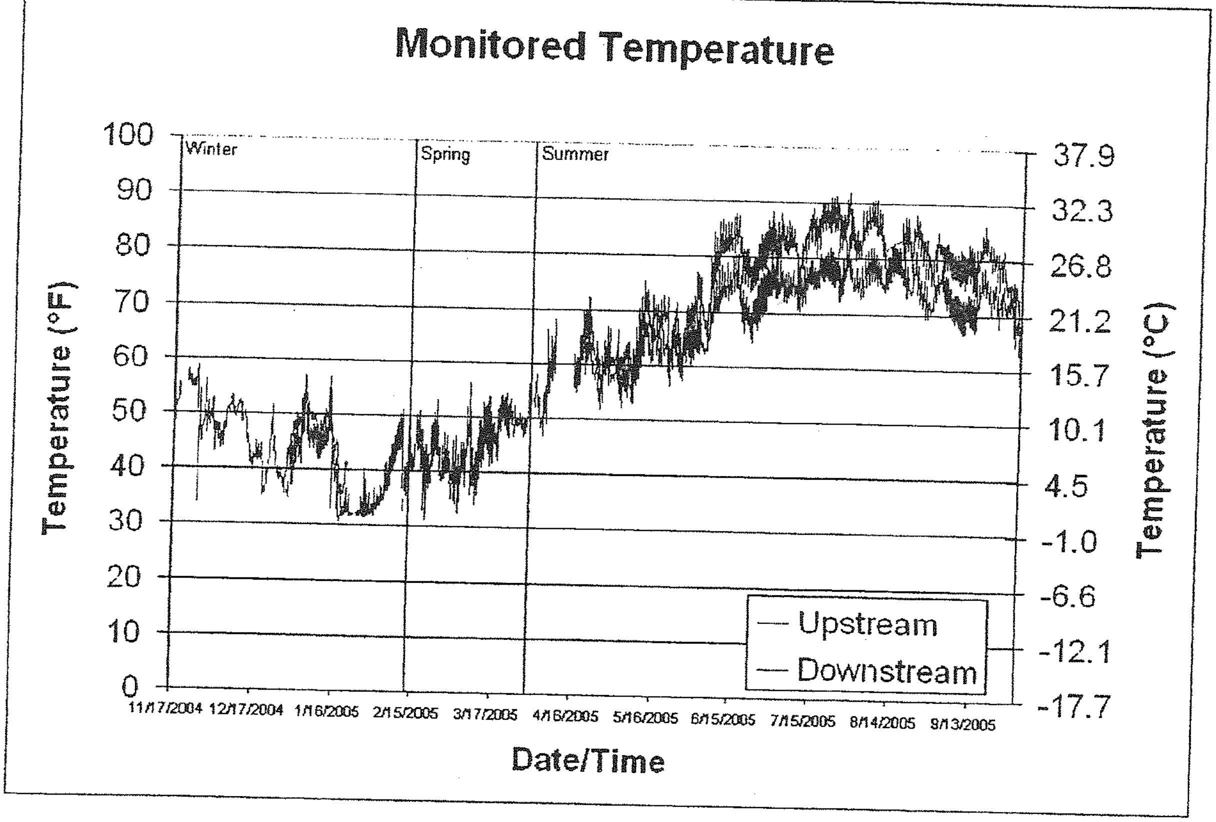


Virginia Water Quality Standards (VWQS) require that state waters (Class I-VI) maintain a pH between 6 and 9 (9 VAC 25-260-50). The 90th percentile pH at the downstream monitoring location is 8.93 for the entire monitored period. The unexpectedly high pH in the Potomac is a driving factor for lower Ammonia Wasteload allocations and permit limits, as will be discussed later in this report. A pH TMDL is currently under development for waters of the Potomac. It is the expectation of the Service Authority that once this TMDL is implemented, Ammonia permit relief may be considered, due to the correlation between pH and ammonia toxicity.

2.3 Temperature Results

Temperature was found to be much less variable than pH. The data show a trend reflective of the seasonal air temperature. Neabsco Creek, a relatively shallow waterbody, experienced especially high temperatures during summer months. Downstream temperatures above 90°F were recorded for a number of days in July and August. The 90th percentile temperature for these summer data is 30°C. Refer to Figure 3 below.

Figure 3 – Monitored Temperature Upstream and Downstream of the Mooney WRF



2.4 Grab Sample Results

In addition to the continuous pH and temperature results presented in the above graphs, grab samples were collected every two weeks at the locations indicated in Figure 1. These grab sample data were used to confirm the VIMS model results. Grab sample data are included in the appendix of this report.

3.0 Data Analysis

H.L. Mooney's current permit is based on a very limited data set collected primarily during daylight hours. As such, the permit uses a number of statistical assumptions as proxies to some of the criteria. Due to the expanded data set collected under this sampling program it is possible to develop a site-specific approach that does not rely on proxy-data. This approach and its results are outlined below.

3.1 Instream Chronic Criteria

Chronic Toxicity as defined by VWQS:

(9 VAC 25-260-140) "Chronic toxicity" means an adverse effect that is irreversible or progressive or occurs because the rate of injury is greater than the rate of repair during prolonged exposure to a pollutant. This includes low level, long-term effects such as reduction in growth or reproduction.

This criterion is further defined as:

(9 VAC 25-260-155b) The thirty-day average concentration of total ammonia nitrogen (in mg N/L) where early life stages of fish are present in freshwater shall not exceed, more than once every three years on the average2, the chronic criteria below:

.198

$$ChronicCriteriaConcentration = \left(\frac{0.0577}{1+10^{7.688-pH}} + \frac{2.487}{1+10^{pH-7.688}}\right) \times MIN$$

(1.0614) (17.2929)

Where MIN = 2.85 or $1.45 \times 10^{0.028(25-T)}$, whichever is less.
T = temperature in °C 1.043

(9 VAC 25-260-155c) thirty-day average concentration of total ammonia nitrogen (in mg N/L) where early life stages of fish are absent (procedures for making this determination are in subdivisions1 through 4 of this subsection), in freshwater shall not exceed, more than once every three years on the average3, the chronic criteria below:

$$ChronicCriteriaConcentration = \left(\frac{0.0577}{1+10^{7.688-pH}} + \frac{2.487}{1+10^{pH-7.688}}\right) \times 1.45\left(10^{0.028(25-MAX)}\right)$$

MAX = temperature in °C or 7, whichever is greater.

3.1.1 Thirty Day Averages

During the previous permit cycle it was not possible to calculate thirty-day criteria as required by Virginia Water Quality Standards. Therefore as a surrogate to the thirty-day values, the 50th percentile temperature and pH values were used to calculate the instream criteria.

As a result of the continuous monitoring that was conducted under this sampling program it was possible to calculate thirty-day average concentrations. The procedure used was as follows; first instantaneous criteria were calculated for each of the time steps in the downstream data record based on the formulas provided in VWQS (above). Second three possible alternatives were considered when calculating the thirty-day criteria:

a) a thirty-day rolling average that included the current day and the previous 30 (30bck)
b) a thirty-day rolling average that included the current day then the next 30 (30fwd)
c) a thirty-day rolling average that included the current day, previous 15 and next 15 days (+/-15)

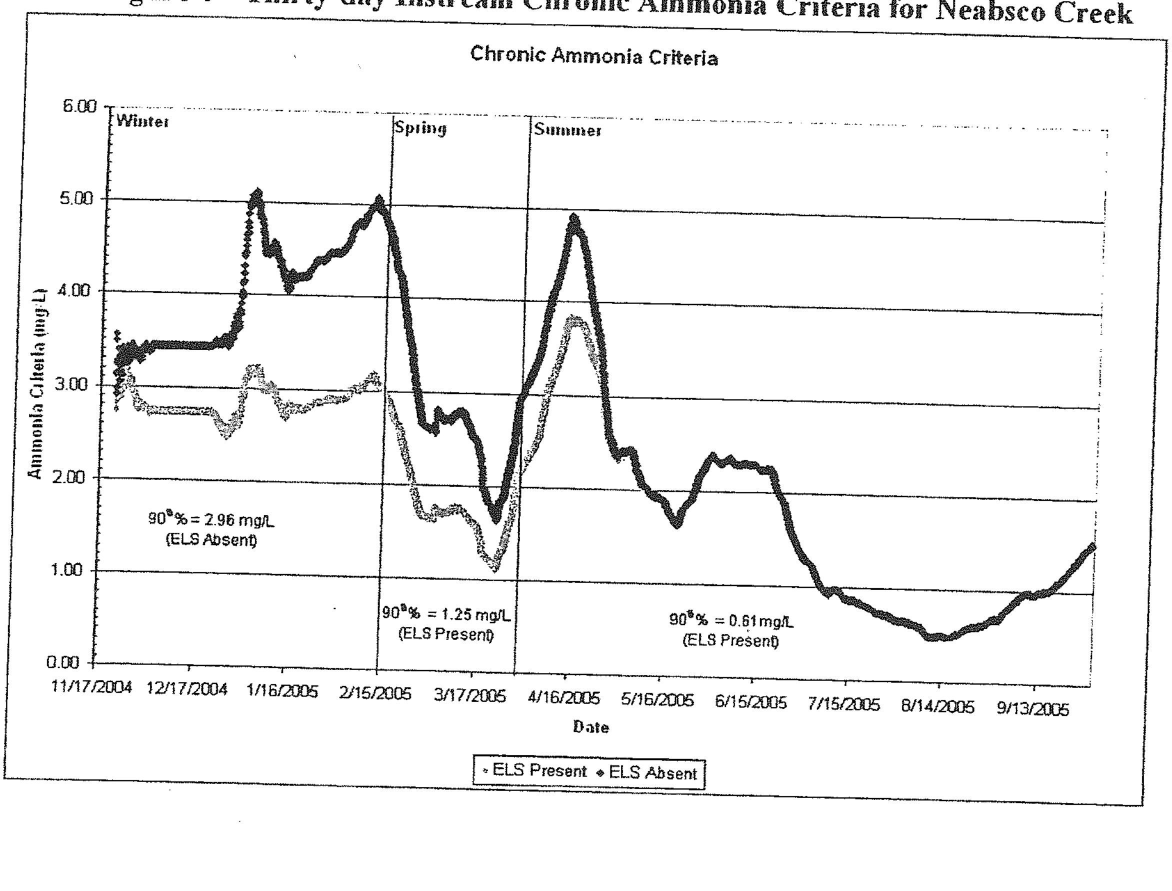
Next, the 90th percentile[1] values were calculated for each of the permit periods (winter, spring and summer) and for each of the thirty-day average alternatives (30bck, 30fwd, +/-15days). This procedure was conducted for both the Early Life Stages (ELS) present and absent status. Finally, *the most conservative value for each permit period was chosen as the instream chronic criteria for that permit period, based on the ELS classification.* The results are show in Table 2 below.

Table 2: 90th Percentile Chronic Criteria

Season/Permit Period	Criteria (mg/L)
Winter (November 1-February 14)	2.96
Spring (February 15- March 31)	1.25
Summer (April 1 - October 31)	0.61

For the winter period the most conservative value for instream chronic criteria was found using the 30fwd option. For the spring and summer periods the most conservative values were found using the 30bck option. Figure 4 below shows the calculated criteria for ELS present and absent based on the 30bck option.

Figure 4 – Thirty-day Instream Chronic Ammonia Criteria for Neabsco Creek



[1] Throughout this report when referring to ammonia criteria, 90th percentile actually refers to the 10th percentile of data since the lower values are of interest.

3.2 Instream Acute Criteria

Acute Toxicity is defined by VWQS as:

(9 VAC 25-260-140) "Acute toxicity" means an adverse effect that usually occurs shortly after exposure to a pollutant. Lethality to an organism is the usual measure of acute toxicity. Where death is not easily detected, immobilization is considered equivalent to death.

This criterion is further defined as:

(9 VAC 25-260-155) The one-hour average concentration of total ammonia nitrogen (in mg N/L) in freshwater shall not exceed, more than once every three years on the average, the acute criteria below [Trout absent]:

$$AcuteCriterionConcentration = \left(\frac{0.411}{1+10^{7.204-pH}} + \frac{58.4}{1+10^{pH-7.204}} \right)$$

The acute criteria must be applied to the segments of Neabsco Creek immediately surrounding the outfall (segments 5 extending to segment 6 in the VIMS model) as this is the location that ammonia concentrations will be the highest due to less dilution. It was therefore necessary to determine the pH in this area to calculate the criteria. The VIMS model, a steady state, hydrogen ion based mixing model allowed the pH to be calculated at the various creek-segments based on the 90th percentile pH of the up and downstream continuous monitors and the 99th percentile of the plant effluent pH. The computed values for segment 6 were used to calculate the instream acute criteria.

Based on the VIMS model runs the 90th percentile acute criteria for the specified permit periods is as follows.

Table 3: 90th Percentile Acute Criteria

	Criteria (mg/L)	
Season/Permit Period	18 MGD	24 MGD
Winter (November 1-February 14)	15.96	18.15
Spring (February 15- March 31)	15.19	17.31
Summer (April 1 - October 31)	14.44	16.49

The instream criteria in segment six in large part reflected the relative low pH values present in the plant effluent. Plant effluent data from January 2001 through September 2005 indicates that the 99th percentile pH for plant effluent is 7.3.

3.3 Wasteload Allocations

Wasteload allocations (WLAs) are determined by multiplying instream criteria by a dilution/decay factor. A site-specific dilution factor has been calculated for chronic wasteload allocations at Neabsco Creek. A default dilution value of 2:1 is used for acute wasteload allocations based on the fact that the acute criteria are defined as one half of the final acute value for a specific toxic pollutant. Decay is then applied on top of the dilution factors to develop the dilution/decay factor.

The 2003 permit recognizes and incorporates a site-specific dilution and decay study conducted by Greeley and Hansen in 1997 titled *Near Field Mixing Analysis and Ammonia Permitting Evaluation for the H.L Mooney Wastewater Treatment Plant* (1997 study). The current evaluation used this study as the basis for developing revised dilution/decay coefficients for the spring and winter permit periods (November 1 through March 31).

The 2003 permit states "Staff's opinion is that nitrification in ambient waters is negligible when temperature is ≤ 10°C." (Fact Sheet page 7). Based on this, decay was not considered during the winter and spring permit periods. The 90th percentile temperature for spring data collected at the downstream probe for this period was 10.4°C. During the winter period the 90th percentile temperature was found to be 11.6°C. These temperatures were applied to the formulas presented in the 1997 study, resulting in the chronic dilution/decay factors shown in Table 4 below.

Table 4 - Calculated Chronic Dilution/Decay Factors

	Temperature	18 MGD		24 MGD	
Season/Permit Period	(90th% - °C)	IWC	Dilution/Delay Factor	IWC	Dilution/Delay Factor
Winter (November 1-February 14)	11.6	24.94%	4.01	26.60%	3.76
Spring (February 15- March 31)	10.4	25.91%	3.86	27.70%	3.61
Summer (April 1 - October 31)*	30.11	18.90%	5.29	20.16%	4.96

*Dilution/Decay Factor from 2003 Permit

WLAs were calculated applying the dilution/decay factors to the instream criteria. The results are presented below in Table 5.

Table 5 - Calculated Wasteload Allocations (mg/L) for 18 and 24 MGD

	18 MGD		24 MGD	
Season/Permit Period	Acute WLA	Chronic WLA	Acute WLA	Chronic WLA
Winter (November 1-February 14)	31.92	11.86	36.29	11.12
Spring (February 15- March 31)	30.38	4.83	34.61	4.52
Summer (April 1 - October 31)	28.88	3.26	32.98	3.05

3.4 Proposed Discharge Limits

Using Version 2.0.4 of the Stats program (WLA.EXE) and the ammonia protocol detailed in Guidance Memo 00-2011, permit limits for the Mooney WRF were calculated from the WLA values. The 1.0 summer limit is required under the Potomac Embayment Standards. The water quality based standards are shown adjacent to the 1.0 requirement. Based on these analyses the proposed permit limits are presented in Table 6 below.

Table 6 – Proposed Permit Limits

	18 MGD		24 MGD	
Season/Permit Period	Weekly Limit	Monthly Limit	Weekly Limit	Monthly Limit
Winter (November 1-February 14)	NL	NL	NL	NL
Spring (February 15- March 31)	5.8	4.8	5.4	4.5
Summer (April 1 - October 31)	3.9	3.3 / 1.0	3.7	3.1 / 1.0

4.0 Conclusion

The sampling conducted under this program allowed the Prince William County Service Authority to collect sufficient data to develop site-specific permit limits. Under the 2003 permit this was not possible due to the limited nature of the data record. The nearly 10 months of continuous monitoring and biweekly grab samples allowed valid thirty-day chronic criteria to be computed and the VIMS model results to be confirmed. Additionally, the newly expanded data set, which included "around the clock" data (rather than those only collected during warmer day-light periods) allowed for the calculation of revised decay rates that we believe more accurately reflect rates throughout the calendar year and across permit periods.

The newly proposed permit limits are slightly more stringent that the 2003 permit limits but reflect a more scientifically based approach than was possible under the previous permit.

Appendix A: Neabsco Creek Grab Sample Data

Date	Temperature by Segment (°C)						
	2	4	5	6	7	8	9
09/14/04	22.2					25.2	25.4
09/23/04	19.3					20.7	20.9
09/30/04	19.9	21.8	21.8	21.6	22.3	21.9	21.9
10/21/04	15.0	15.3	15.2	14.8	14.6	14.5	14.5
10/28/04	13.6	14.0	14.9	14.3	14.3	14.3	14.1
11/16/04	9.9	11.4	12.5	9.0	8.9	9.2	9.0
12/02/04	8.3	8.1	10.0	14.6	11.0	9.0	7.9
12/14/04	5.6					5.6	6.3
01/26/05	4.3	3.3	4.7	6.9	1.2	0.5	0.3
04/11/05	15.3	16.4	16.4	16.6	17.0	17.3	16.8
05/26/05	14.9	16.0	16.4	16.2	16.3	16.6	16.5
06/01/05	17.3					21.1	20.9
06/23/05	21.7	23.4	23.1	23.6	24.1	26.2	25.4
07/05/05	23.7	26.6	26.2	26.8	26.8	27.4	27.8
07/21/05	25.5	27.1	27.8	28.1	28.1	29.6	30.6
08/11/05	24.4	25.5	26.1	26.9	28.1	28.7	29.1
08/22/05	24.2	27.2	27.6	28.1	28.3	28.9	28.8
09/06/05	21.1	24.3	24.8	24.7	24.7	25.1	25.1
09/21/05	22.1	23.4	23.9	23.8	24.2	25.2	25.2

Date	pH by Segment (standard units)						
	2	4	5	6	7	8	9
09/14/04	7.8					7.4	7.8
09/30/04	7.1	7.0	7.4	7.8	7.9	7.9	8.0
10/21/04	7.3	7.2	7.3	7.2	7.3	7.5	7.5
10/28/04	7.2	7.6	7.5	7.8	7.7	7.8	7.8
11/16/04	6.9	7.2	7.1	6.9	7.0	7.1	7.3
12/02/04	8.0	7.1	7.6	7.8	7.7	7.2	7.3
12/14/04	7.5					7.3	7.5
01/26/05	7.0	6.8	7.1	7.5	7.2	7.1	7.1
04/11/05	7.4	7.1	7.2	7.2	6.9	7.8	7.6
05/26/05	8.3	8.0	7.9	7.9	7.8	8.1	7.9
06/01/05	8.4					7.6	7.6
06/23/05	7.8	7.8	7.7	7.8	8.0	9.1	9.2
07/05/05	7.4	7.4	7.5	7.6	7.6	7.7	8.2
07/21/05	8.0	7.5	7.5	7.6	7.6	7.9	9.0
08/11/05	7.8	7.6	7.4	7.5	8.0	9.1	9.4
08/22/05	8.2	7.9	8.1	8.4	8.6	9.0	9.1
09/06/05	7.1	7.5	7.6	7.8	8.1	8.8	8.9
09/21/05	7.8	7.6	7.4	7.4	7.4	7.6	7.6

Note: Due to tidal conditions, some segments cannot be reached at all times. Therefore, there will be some blanks for segments 4 to 7.

Glenn Harvey
Prince William County Service Authority
4 County Complex Court
Raymond Spittle Building
Woodbridge, VA 22192

April 15, 2008

**Re: Calculation of Proposed Ammonia Limits for H.L. Mooney Water Reclamation Facility
VPDES Permit No. VA0025101**

Dear Mr. Harvey:

In accordance with your request, we have re-calculated the appropriate ammonia criteria, wasteload allocations, and proposed permit limits for the H.L. Mooney Water Reclamation Facility based on the following Seasons / Permit Periods:

Winter (Nov 1 - Jan 31)
Spring (Feb 1 - Mar 31)
Summer (April 1 - Oct 31)

The prior report on this topic, *Instream Monitoring Report for the Evaluation of Ammonia Effluent Limitations, 2005* used a Feb 15 date for the break between Winter and Spring permit periods.

The change in permit period results in small changes to the criteria, wasteload allocations and permit limit calculations in several tables in the report. Below are shown Tables 5 and 6, which detail the Calculated Wasteload Allocations and the Proposed Permit Limits.

Table 5: Calculated Wasteload Allocations (mg/L) for 18 and 24 MGD

	18 MGD		24 MGD	
Season/ Permit Period	Acute WLA	Chronic WLA	Acute WLA	Chronic WLA
Winter (Nov 1 - Jan 31)	31.92	13.55	36.30	12.71
Spring (Feb 1 - Mar 31)	30.38	4.90	34.62	4.58
Summer (April 1 - Oct 31)	28.88	3.23	32.98	3.03

Table 6: Proposed Permit Limits

	18 MGD		24 MGD	
Season/ Permit Period	Weekly Limit	Monthly Limit	Weekly Limit	Monthly Limit
Winter (Nov 1 - Jan 31)	NL	NL	NL	NL

Spring (Feb 1 - Mar 31)	5.9	4.9	5.5	4.6
Summer (April 1 - Oct 31)	3.9	3.2	3.6	3.0

Note that the current analysis did not rerun the mixing model used in the 1997 report, *Near Field Mixing Analysis and Ammonia Permitting Evaluation for the H.L. Mooney Wastewater Treatment Plant*, to recalculate dilution and decay factors. The current analysis also did not rerun the VIMS model to recalculate acute criteria, as was done in the 2005 report.

Please let us know if we can provide additional information to you.

Sincerely,

Daniel Schechter, PE
Associate

TO: Alison Thompson, VDEQ
FROM: Daniel Schechter
DATE: June 2, 2009

RE: **Ammonia Limits for H.L. Mooney WRF based on 2005 - 2006 Neabsco Creek pH and Temperature Data**

Please find attached our analysis of the Neabsco Creek pH and Temperature data for the summer period for 2005-2006 and calculations of the Ammonia limits. As discussed, we have combined the 2005 data set collected by PWCSA and the 2006 data set collected by VDEQ.

The 30-day average chronic ammonia criteria was calculated using three methods (forward 30 days, back 30 days, and +/- 15 days) as was done in the prior Monitoring Report. The 90th percentile of the 30-day average chronic ammonia criteria was calculated, and the most stringent of the 3 methods above was selected to determine the appropriate instream criteria level.

Analysis of the 2005 data set and the 2006 data set are shown in separate columns of the attached spreadsheet, and the combined data is shown in the last column of the spreadsheet. There was a difference in the number of data points for each data set. The 2005 summer data was on a 2 hour interval while the 2006 summer data was on a 15 minute interval. To calculate an accurate 90th percentile for the 2005-2006 period, we performed the following data analysis:

1. The 30-day average ammonia criteria were calculated for each timestamp in 2005-2006 using all the data available.
2. The 2006 data was then extracted on a 2 hour interval.
3. The average, 50th percentile, and 90th percentile were calculated on the combined 2005-2006 data.

The analysis resulted in a 90th percentile chronic ammonia criteria (ELS present) of **0.69 mg/L** as N. Using the dilution factors shown in the draft permit of 5.29 (18 MGD) and 4.96 (24 MGD) results in a monthly limit of **3.7 mg/L (18 MGD)** and **3.4 mg/L (24 MGD)**. Using the STATS.EXE program to compute the weekly limit results in weekly limits of **4.4 mg/L (18 MGD)** and **4.1 mg/L (24 MGD)**.

Based on this analysis, we request the following weekly permit limits for ammonia:

	Weekly Limit
18 MGD	4.4 mg/L as N
24 MGD	4.1 mg/L as N

Please contact me if you have any questions or comments.

Daniel Schechter, P.E.
Associate
Greeley and Hansen

Attachment 9

Calculation of Summer Ammonia Permit Limits

	Data Source for Temperature and pH Data					
	2006 VDEQ, 90th percentile pH, Temp	2005 PWCSA, 90th percentile pH and Temp	VDEQ Draft Permit Values	2005 PWCSA Data, 90th percentile of 30 day average	2006 VDEQ Data, 90th percentile of 30 day average	2005 PWCSA + 2006 VDEQ Data, 90th percentile of 30 day average
Chronic Ammonia Criteria	0.29	0.21	0.46	0.61	0.88	0.69
Dilution/Decay Factor (18 MGD)	5.29	5.29	5.29	5.29	5.29	5.29
Dilution/Decay Factor (24 MGD)	4.96	4.96	4.96	4.96	4.96	4.96
Monthly Ammonia Limit (18 MGD)	1.53	1.12	2.43	3.23	4.66	3.65
Monthly Ammonia Limit (24 MGD)	1.43	1.05	2.28	3.03	4.36	3.42
Weekly Ammonia Limit (18 MGD)	1.83	1.34	2.92	3.87	5.59	4.38
Weekly Ammonia Limit (24 MGD)	1.72	1.26	2.74	3.63	5.24	4.11

VaFWIS - Department of Game and Inland Fisheries

38,36,39.0 -77,16,13.0 **is the Search Point**

[Submit] [Cancel]

Search Point

- **Change** to "clicked" map point
- **Fixed** at 38,36,39.0 -77,16,13.0

Show Position Rings

Yes No

1 mile and 1/4 mile at the **Search Point**

Show Search Area

Yes No

2 Search distance miles radius

Search Point is at map center

Base Map Choices

Topography

Map Overlay Choices

Current List: Position, Search

Map Overlay Legend

Position Rings 1 mile and 1/4 mile at the Search Point

2 mile radius Search Area

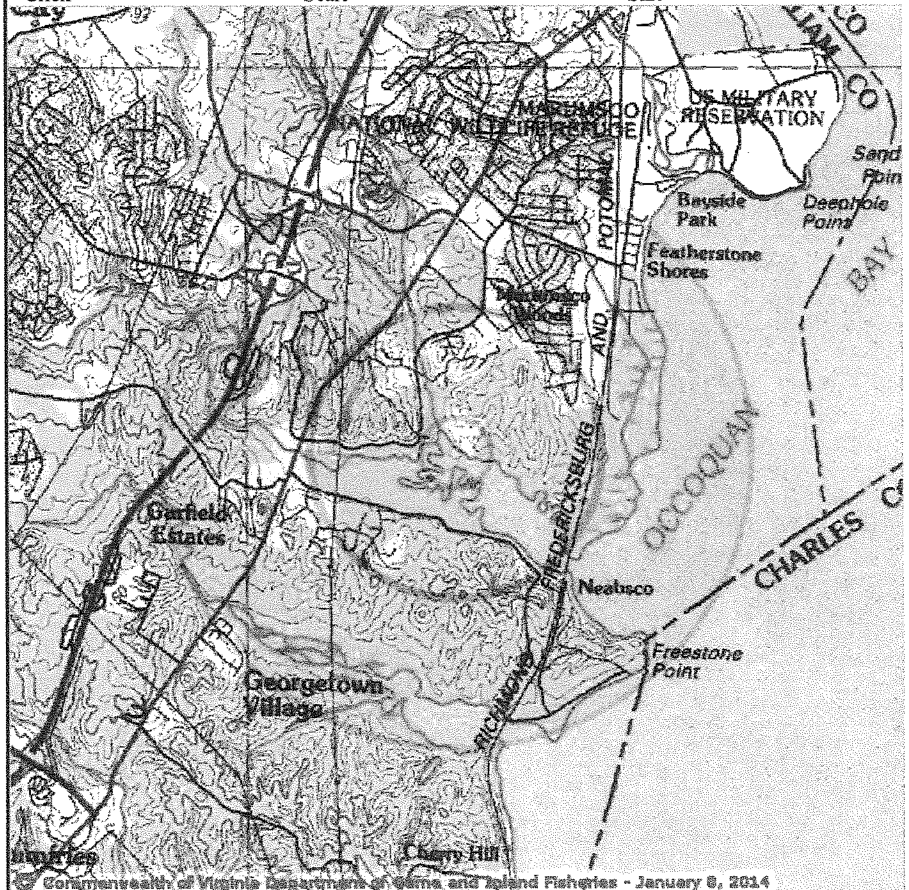
| Refresh Browser Page |

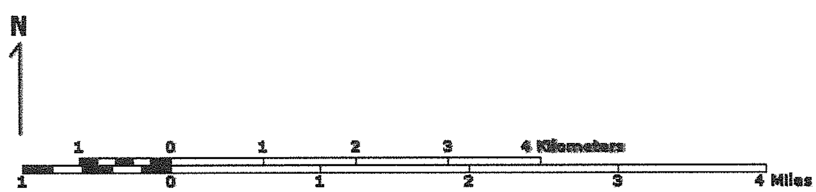
Map Click Pan

Map Scale In Zoom Out

Screen Size Small Size Big

| Help |





Point of Search 38,36,39.0 -77,16,13.0
Map Location 38,36,39.0 -77,16,13.0

Select **Coordinate System:**
- Degrees,Minutes,Seconds Latitude - Longitude
- Decimal Degrees Latitude - Longitude
- Meters UTM NAD83 East North Zone
- Meters UTM NAD27 East North Zone

Base Map source: USGS 1:100,000 topographic maps (see Microsoft terraserver-usa.com for details)

Map projection is UTM Zone 18 NAD 1983 with left 297531 and top 4280836. Pixel size is 16 meters . Coordinates displayed are Degrees, Minutes, Seconds North and West.Map is currently displayed as 600 columns by 600 rows for a total of 360000 pixles. The map display represents 9600 meters east to west by 9600 meters north to south for a total of 92.1 square kilometers. The map display represents 31501 feet east to west by 31501 feet north to south for a total of 35.5 square miles.

Topographic maps and Black and white aerial photography for year 1990+-

Attachment 10

are from the United States Department of the Interior, United States Geological Survey.
Color aerial photography aquired 2002 is from Virginia Base Mapping Program, Virginia Geographic Information Network.
Shaded topographic maps are from TOPO! ©2006 National Geographic http://www.national.geographic.com/topo
All other map products are from the Commonwealth of Virginia Department of Game and Inland Fisheries.

map assembled 2014-01-08 10:48:41 (qa/qc December 5, 2012 8:04 - tn=512929 dist=3218 I)
$poi=38.6108333 -77.2702777

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VaFWIS Initial Project Assessment Report Compiled on 1/8/2014, 10:49:17 AM

Help

Known or likely to occur within a **2 mile radius around point 38,36,39.0 77,16,13.0** in **153 Prince William County, VA**

View Map of Site Location

493 Known or Likely Species ordered by Status Concern for Conservation
(displaying first 24) (24 species with Status* or Tier I** or Tier II**)

BOVA Code	Status*	Tier**	Common Name	Scientific Name	Confirmed	Database(s)
010032	FESE	II	Sturgeon, Atlantic	Acipenser oxyrinchus		BOVA
060006	SE	II	Floater, brook	Alasmidonta varicosa		BOVA
030062	ST	I	Turtle, wood	Glyptemys insculpta		Habitat
040129	ST	I	Sandpiper, upland	Bartramia longicauda		BOVA
040293	ST	I	Shrike, loggerhead	Lanius ludovicianus		BOVA
040379	ST	I	Sparrow, Henslow's	Ammodramus henslowii		BOVA
040292	ST		Shrike, migrant loggerhead	Lanius ludovicianus migrans		BOVA
010038	FC	IV	Alewife	Alosa pseudoharengus		BOVA
010045	FC		Herring, blueback	Alosa aestivalis		BOVA
100248	FS	I	Fritillary, regal	Speyeria idalia idalia		BOVA
040093	FS	II	Eagle, bald	Haliaeetus leucocephalus	Yes	BOVA,BECAR,Habitat,BAEANests
060029	FS	III	Lance, yellow	Elliptio lanceolata		BOVA
030063	CC	III	Turtle, spotted	Clemmys guttata		BOVA
030012	CC	IV	Rattlesnake, timber	Crotalus horridus		BOVA
040372		I	Crossbill, red	Loxia curvirostra		BOVA
040225		I	Sapsucker, yellow-bellied	Sphyrapicus varius		BOVA
040319		I	Warbler, black-throated green	Dendroica virens		BOVA
040306		I	Warbler, golden-winged	Vermivora chrysoptera		BOVA
040038		II	Bittern, American	Botaurus lentiginosus		Habitat
040052		II	Duck, American black	Anas rubripes		BOVA
040213		II	Owl, northern saw-whet	Aegolius acadicus		BOVA
040105		II	Rail, king	Rallus elegans		BOVA,Habitat
040320		II	Warbler, cerulean	Dendroica cerulea		BOVA

	Highest TE*	BOVA Code, Status*, Tier**, Common & Scientific Name					
(20700102)	ST	030062	ST	I	Turtle, wood	Glyptemys insculpta	Yes
Farm Creek (20700102)	ST	030062	ST	I	Turtle, wood	Glyptemys insculpta	Yes
Neabsco Creek (20700102)	ST	030062	ST	I	Turtle, wood	Glyptemys insculpta	Yes

Habitat Predicted for Terrestrial WAP Tier I & II Species (3 Species)

View Map of Combined Terrestrial Habitat Predicted for 3 WAP Tier I & II Species Listed Below

ordered by Status Concern for Conservation

| Wednesday, January 08, 2014 10:49:31 AM | DGIF | Credits | Disclaimer | Please view our privacy policy |

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COMMONWEALTH OF VIRGINIA
DEPART' 'ENT OF ENVIRONME' 'AL QUALITY

Water Division - Office of Water Permit Support
629 East Main Street Richmond, Virginia 23219

M E M O R A N D U M

Subject: Mooney WTP mixing analysis

RECEIVED
FEB 20 1997
Northern VA. Region
Dept. of Env. Quality

To: Lyle Anne Collier, NRO

From: M. Dale Phillips, OWPS Dale

Date: February 18, 1997

Copies:

I have completed a review of the technical memorandum that addresses the comments we had on the original study and provides additional material. I believe that the 1995 mixing study and this addendum provide estimates of exposure times that are sufficiently reasonable to provide the basis for the calculation of permit limits.

Call if you have questions or comments.

Attachment 11

Division of Engineering & Wastewater

Richard C. Thoesen, P.E., Director

Prince William County Service Authority

H. L. Mooney Wastewater Treatment Plant
P. O. Box 2266 • 1851 Rippon Boulevard • Woodbridge, Virginia 22193-0266 • (703) 670-8101 • Fax (703) 670-8101

January 24, 1997

RECEIVED
JAN 24 1997
Northern VA. Region
Dept. of Env. Quality

Ms. Lyle Anne Collier
Virginia Department of Environmental Quality
Northern Virginia Regional Office
13901 Crown Court
Woodbridge, VA. 22193

Subject: Prince William County Service Authority
H. L. Mooney WWTP NPDES Permit Reissuance

Dear Ms. Collier:

We are pleased to provide the enclosed copies of the technical memorandum "Near Field Mixing Analysis and Ammonia Permitting Evaluation for the H. L. Mooney Wastewater Treatment Plant". We believe this document provides a technically sound basis for winter time ammonia permit limits and also shows that the proposed Potomac Embayment Standards for ammonia are fully protective during the summertime.

Based on the analyses the requested instream waste concentrations (IWC) to use in assessing the chronic toxicity potential of substances and whole effluent are as follows:

Mooney WWTP Flow Conditions	IWC
@ 18 MGD (winter)	37.92%
(summer)	39.17%
@ 24 MGD (winter)	40.53%
(summer)	41.84%

The requested ammonia permit limits (in mg/L as N) for the Mooney WWTP are as follows:

Mooney WWTP Flow Conditions	Monthly Avg	Weekly Avg
18 MGD (winter)	5.35	6.58
(summer)	1.0	-
24 MGD (winter)	4.65	5.72
(summer)	1.0	-

These effluent limits for ammonia do not reflect any additional relief offered by the outcome of our proposed site-specific ammonia study. We will keep you appraised of our progress.

Please call Mark Kennedy (301-817-3700) or Steve Bennett (703-670-8101) if you have questions or if you would like to discuss these issues further.

Sincerely,

Richard C. Thoesen, P.E.
Director of Engineering & Wastewater

Attachments

cc: Robert Canham
Steve Bennett
Mark Kennedy (Greely & Hansen)

MK/RCT/RAC/pa

PRINCE WILLIAM COUNTY SERVICE AUTHORITY
BASIC ORDERING AGREEMENT, TASK ORDER NO. 14

Technical Memorandum

Near Field Mixing Analysis and Ammonia Permitting Evaluation for the H.L. Mooney Wastewater Treatment Plant

Greeley and Hansen
January 1997

1. INTRODUCTION

The Prince William County Service Authority's (PWCSA) H. L. Mooney Wastewater Treatment Plant discharges treated effluent to Neabsco Creek, a constricted embayment of the Potomac River. The Plant effluent must meet the requirements of the Potomac Embayment Standards (PES) for ammonia in the summer months (April-October) and water quality-based ammonia standards in the winter months (November-March). Specifically, the PES require a 30-day average effluent concentration of 1 mg/L of ammonia as nitrogen (April through October) and the water quality-based standards are those published in the Virginia Water Quality Standards at VR 680-21-01.14.B.

The Virginia Department of Environmental Quality (VDEQ) developed preliminary permit limits for ammonia and initiated discussions with the PWCSA as part of the VPDES permit reissuance process. The purpose of this technical memorandum is to assist the PWCSA in developing appropriate water quality-based permit limits for ammonia and to address updates to the Neabsco Creek dilution model, near-field mixing and an evaluation of ambient pH and temperature data used in the ammonia permitting process for the Mooney WWTP.

2. Neabsco Creek Dilution Modeling - Update

A report on the first phase of the dilution study was submitted to the VDEQ for review and provided a technical basis for ammonia permit limitations necessary in the Mooney WWTP permit (Greeley and Hansen and Limno-Tech, Inc., 1995). The report predicted dilution rates for the Mooney WWTP effluent in the various Neabsco Creek Model sections, the times of exposure for a drifting organism and the length of time necessary to flush and replace the receiving water in the vicinity of the Mooney WWTP outfall.

VDEQ reviewed the report and made the following observations (M. Dale Phillips, 1996):

a. The Neabsco Creek Model assumes complete mix in each of the model segments and therefore cannot be used to define the extent of acute physical mixing area (PMA).

b. The hydraulic behavior of the system [Neabsco Creek] is well known because the model was calibrated and verified using dye study results.

c. Hydraulic flushing time and drifting organism exposure predictions are a valid means of defining the duration of exposure for chronic toxicity.

d. Flushing time in the lower segments of Neabsco Creek [nearer to the Potomac River] need to be included in the evaluation before approval of the results for chronic toxicity may be made.

VDEQ staff requested that the Dale City WWTP flow be considered as a pollutant source equivalent to the Mooney WWTP. Model runs were subsequently run incorporating these additional factors in order to fully address VDEQ concerns.

2.1 Near-Field Mixing Evaluation

The purpose of the near-field mixing evaluation is to confirm that rapid and complete mixing takes place within model segments 5 and 6 of Neabsco Creek and to establish, if possible, the extent of an acute physical mixing area.

The following elements are incorporated into a CORMIX (version 3.1) analysis of the near-field mixing.

- Maintaining the Mooney WWTP flows at 18 and 24 MGD
- Varying mannings "n" factor (for friction) to assess the effect of aquatic vegetation on mixing characteristics.
- Summer (7Q10=0.0 MGD) and winter (7Q10=1.03 MGD) ambient upstream flow
- Dale City WWTP flow equal to 6 MGD
- Mixing plume buoyancy due to temperature effects
- Additional inputs necessary for the model as shown in Attachment 1

The predicted distance and travel time to achieve complete mixing for each scenario is as follows:

Complete Mixing Distance and Travel Time
for H.L. Mooney WWTP Discharge to Neabsco Creek.

Seasonal and tidal conditions	Mooney @ 18 MGD		Mooney @ 24 MGD	
	Distance (meters)	Time (hours)	Distance (meters)	Time (hours)
Summer				
No tidal movement	131	1.3	235	2.4
With tidal movement	70	0.8	70	0.6
Winter				
No tidal movement	185	5.9 (1)	70	0.9
With tidal movement	69	0.9	77	1.0

Note: (1) This predicted travel time is inconsistent with other results and may be overestimated.

The following conclusions are based on the results of the near-field simulations:

a. For both summer and winter conditions, CORMIX3 confirms that the Mooney WWTP effluent completely mixes across Neabsco Creek within a maximum distance of 69 to 235 meters, depending on the season, tidal conditions and effluent flow rate.

b. The predicted maximum complete mix distance is less than the length of the VIMS Neabsco Creek Model segments 5 and 6, which are 360 and 490 meters respectively. Therefore, the VIMS Neabsco Creek Model complete mix assumption is valid.

c. The relationship between the travel times are generally correct (except for one winter simulation noted above) and the times are less than or equal to one hour when tidal movement is considered.

d. Varying Mannings "n" friction factor had little or no effect on the near field mixing characteristics. Therefore, the presence of aquatic vegetation should not significantly affect mixing characteristics or the extent of the physical mixing area.

2.2 Updated Neabsco Creek Dilution Analysis

The Neabsco Creek Model was applied to evaluate dilution in Neabsco Creek in the previous report. This model is rerun here to respond to VDEQ comments and incorporates the following changes:

- Maintaining the Mooney WWTP flows at 18 and 24 MGD.
- Separate summer (7Q10 = 0.0 MGD) and winter conditions (7Q10 = 1.03 MGD) as provided by VDEQ.
- Dilution with settling and without settling.
- Dale City WWTP flow equal to 6.0 MGD with the same pollutant concentrations as the Mooney WWTP (i.e. no dilution from the Dale City flow).

The results of the model are presented in Table 1 (Dilution Rates) and in Table 2 (Exposure Times). These updated results do not indicate as much dilution available as in the previous model runs. They do, however, provide a basis for dilution for both the Dale City and Mooney WWTPs based on drifting organism exposure.

2.3 Drifting Organism Exposure Analysis for Chronic Toxicity Evaluation

Neabsco Creek is a tidally flushed, constricted embayment of the Potomac River. The creek is neither free flowing nor a deep tidal water and therefore falls outside the normal pattern described in VDEQ guidance. A drifting organism exposure time of two days (instead of four days) was used in accordance with VDEQ guidance to judge the acceptability of an effluent with regard to chronic toxicity. This approach was discussed in detail in the previous report (Greeley and Hansen and Limno-Tech, Inc., 1995).

VDEQ requested in their review of the previous report, that the Dale City WWTP flow be included in the model as a pollutant source equal to the Mooney WWTP. The updated Neabsco Creek dilution analysis incorporates this recommendation. However, this modification results in the model describing not only the Mooney WWTP impact but the impacts of the Dale City WWTP as well. Since there are no other point source discharges to Neabsco Creek, the updated model results provide a basis for a wasteload allocation for the entire water body. As such, it is appropriate to consider a drifting organism exposure to chronic toxicity for a full four (4) days rather than two (2) days. The safety factor to account for additional discharges need not be maintained since both dischargers to Neabsco Creek have been incorporated into the same model.

The method to calculate the average effluent exposure of a drifting organism is to multiply the dilution factor in each segment (in terms of percent effluent) by the time the organism is resident in that segment. The products of segment dilutions and exposure times are then added and the sum is divided by the cumulative exposure for the organism -- held to four days for the purposes of chronic toxicity evaluations. The calculations for the Mooney WWTP are in Attachment 2 and the results are as follows:

Average Four-Day Effluent Exposure for a Drifting Organism (as percent effluent)		
Season	Mooney @ 18 MGD	Mooney @ 24 MGD
Apr - Oct	39.17% (1)	41.84% (2)
Nov - Mar	37.92% (1)	40.53% (3)

Notes: (1) Four-day exposure terminates in model segment 9.
(2) Four-day exposure terminates in model segment 10.
(3) Four-day exposure terminates just inside model segment 11.

The 4-day exposure in each scenario begins in model segment 5 and terminates in model segments 9, 10 or 11 depending on the ambient conditions and WWTP flow. This means that the drifting organism, beginning at segment 5 (the Mooney discharge) will drift to segments 9, 10 or 11 in four days. The exposures shown above (as percent effluent) are for conservative substances which do not settle or decay and are appropriate for whole effluent toxicity testing evaluations. However, ammonia is not a conservative substance and undergoes decay as it is converted into different nitrogen forms. A first order decay rate coefficient of 0.2 day^{-1} was derived by the Virginia Institute of Marine Sciences (VIMS) and used in the original Neabsco Creek model to predict this ammonia decay. This original decay rate coefficient was based on an ambient temperature of 20°C but can be adjusted to other temperatures using VDEQ guidance (OWRM Guidance memo No. 93-015, Amendment No. 1 -- Mixing Zones, page 18).

VDEQ policy calls for consideration of ammonia decay only in the summer months but not in the winter. The reason for the policy is that ammonia decay is reduced with temperature. However, VDEQ guidance also bases the water quality standard for ammonia on the 90th percentile temperature, which for Neabsco Creek is 18.8°C. The ammonia decay rate coefficient has been reduced here for the 90th percentile temperature of the winter months. The combination of conservative factors including the biased high pH is reason to consider inclusion of a temperature adjusted decay as a reasonable basis for permit calculation. Adjusting the coefficient to the 90th percentile temperature of Neabsco Creek (i.e. 18.8°C) results in a new coefficient of 0.1824 day^{-1}. Applying this rate of decay for the four days of exposure would reduce the effluent exposure for ammonia as follows:

Average Four-Day Ammonia Exposure for a Drifting Organism (as percent effluent)				
Season	Mooney @ 18 MGD		Mooney @ 24 MGD	
	IWC	Dilution Rate	IWC	Dilution Rate
Apr - Oct	18.89%	5.29	20.18%	4.96
Nov - Mar	18.28%	5.47	19.54%	5.12

These ammonia exposure concentrations should be used to calculate the ammonia wasteload allocation for the Mooney WWTP.

3. Development of Ammonia Wasteload Allocations and Permit Limitations

The wasteload allocation can be calculated by dividing the water quality standard by the effective dilution factor expressed as percent effluent. These latter dilution factors have been determined in the previous section. The selection of the appropriate water quality standard for ammonia depends on the ambient pH and temperature of the receiving water.

3.1 Selection of ambient pH and temperature values and the resulting ammonia water quality standard

Several sets of pH and temperature data have been identified in the permitting process by VDEQ. These data are from the Mooney WWTP effluent, Neabsco Creek 50 feet above the Mooney WWTP outfall, Neabsco Creek at the Route 1 bridge and midway into Neabsco Bay. Other pH data useful to the permitting process are at Belmont Bay and at stations in the nearby Potomac River shown in Figure 1. VDEQ guidance requires the use of 90th percentile data to evaluate ammonia toxicity. The 90th percentiles of available pH data are as follows:

Data Source	Number of Data Points	90th Percentile pH Value
Mooney WWTP Effluent	1645	7.23
Neabsco Creek 50' above the Mooney WWTP Outfall	234	7.83
Neabsco Creek @ Route 1	141	7.5
Neabsco Bay	214	9.7
Belmont Bay	206	9.9
Woodrow Wilson Bridge (Potomac)	33,684	8.0
Dogue Creek (Potomac)	579	8.1
Indian Head, MD (Potomac)	1176	8.2
Quantico Creek (Potomac)	757	8.1
Aquia Creek (Potomac)	585	8.0

From the pH data available, the following observations and conclusions should be made:

a. Potomac River 90th percentile pHs are consistent both above and below Neabsco Bay

The data indicate mild pH fluctuations depending on the time of year, with higher pHs measured in the summer months due to increased photosynthetic activity. The Woodrow Wilson Bridge Station was measured continuously from 1989-1992 and demonstrated the diurnal pattern of pH fluctuations due to photosynthetic activity.

b. <u>Neabsco and Belmont Bays, both adjacent to the Occoquan Bay, have the highest 90th percentile pHs.</u>

Neabsco and Belmont Bays are shallow embayments of the Potomac River. Their shallow depth permits higher temperatures and more light penetration to support aquatic plant life. The pH swings in these waterbeds are reflective of this increased photosynthetic activity. Clearly, if the ambient pH of these bays were consistently above 9.0, the aquatic life in these and adjacent water bodies would be adversely affected. The highest pH values typically occur in the early to mid-afternoon which is when sampling usually occurs. If pH sampling were continuous, including night and early morning readings, the 90th percentile values for these bays would be shown to be lower. This high pH bias adds a level of conservatism to the analysis of the data.

c. <u>Neabsco Creek 90th percentile pHs are lower than the 90th percentile pHs in the</u> embayments and the Potomac River.

The low dilution predicted in the Neabsco Creek (i.e. the high percentage of effluent in the creek) indicates that effluent characteristics will influence the creek more than the ambient water available from the incoming stream and tidal movements. The pH data bears this out with the WWTP effluents effectively buffering the ambient Neabsco Creek pH. The Neabsco Creek 90th percentile pH is 7.83 (not greater than 9.0 as in Neabsco Bay) and is greatly influenced by the effluents of the Dale City and Mooney WWTPs due to the minimal dilution available. As the Mooney WWTP expands and increases its flow to 18 and 24 MGD, the influence of the treated effluents on pH will also increase. It is important to note that photosynthetically induced diurnal pH fluctuation also occurs in Neabsco Creek, but with a lower amplitude due to the buffering effect of the WWTP effluents. However, it can be expected that the Neabsco Creek pH of 7.83 is also biased high due to the time of sampling.

The ambient pH and temperature selected to determine the ammonia water quality standard should reflect the conditions of the water body in question. Since the drifting organism will remain within Neabsco Creek for almost the entire four days, the chronic ammonia water quality standard, which is applied as a four-day exposure, should be based on the available Neabsco Creek pH and temperature data. Therefore the Neabsco Creek pHs (7.82 for summer and 7.86 for winter) and temperatures (27°C for summer and 18.8°C for winter) can be used to calculate the chronic ammonia criteria. See p 7a & 7b for the derivation of these values Jac

The higher pH values of Neabsco Bay should not be used to calculate the chronic ammonia criteria for the following reasons:

Calculating the Exposure Concentration for a Drifting Organism in Neabsco Bay

(Temperature Data from G&H, 2005; Other information is taken directly from G&H, 1997)

Winter Conditions (11/1 to 2/14), Mooney @ 18 MGD

Segment	Dilution	%Effluent (1/dilution)	Exposure Time (days)	Cumulative Exposure (days)	Exposure Product
5	1.4	0.714	0.19	0.19	0.136
6	1.6	0.625	0.47	0.66	0.294
7	2	0.500	0.28	0.94	0.140
8	2.7	0.370	1.2	2.14	0.444
9	3.7	0.270	1.86	4	0.503
Total					1.517

Effluent Exposure	37.92%
Temperature (degrees C)	11.6
Ammonia Decay	0.1050
Ammonia Exposure	**24.91%**
Dilution Ratio	**4.01**

Winter Conditions (11/1 to 2/14), Mooney @ 24 MGD

Segment	Dilution	%Effluent (1/dilution)	Exposure Time (days)	Cumulative Exposure (days)	Exposure Product
5	1.3	0.769	0.16	0.16	0.123
6	1.4	0.714	0.38	0.54	0.271
7	1.7	0.588	0.23	0.77	0.135
8	2.3	0.435	0.97	1.74	0.422
9	3.1	0.323	1.9	3.64	0.613
10	5.3	0.189	0.28	3.92	0.053
11	19.8	0.051	0.08	4	0.004
Total					1.621

Effluent Exposure	40.53%
Temperature (degrees C)	11.6
Ammonia Decay	0.1050
Ammonia Exposure	**26.63%**
Dilution Ratio	**3.76**

Spring Conditions (2/15 to 3/31), Mooney @ 18 MGD

Segment	Dilution	%Effluent (1/dilution)	Exposure Time (days)	Cumulative Exposure (days)	Exposure Product
5	1.4	0.714	0.19	0.19	0.136
6	1.6	0.625	0.47	0.66	0.294
7	2	0.500	0.28	0.94	0.140
8	2.7	0.370	1.2	2.14	0.444
9	3.7	0.270	1.86	4	0.503
Total					1.517

Effluent Exposure	37.92%
Temperature (degrees C)	10.4
Ammonia Decay	0.0955
Ammonia Exposure	**25.88%**
Dilution Ratio	**3.86**

Spring Conditions (2/15 to 3/31), Mooney @ 24 MGD

Segment	Dilution	%Effluent (1/dilution)	Exposure Time (days)	Cumulative Exposure (days)	Exposure Product
5	1.3	0.769	0.16	0.16	0.123
6	1.4	0.714	0.38	0.54	0.271
7	1.7	0.588	0.23	0.77	0.135
8	2.3	0.435	0.97	1.74	0.422
9	3.1	0.323	1.9	3.64	0.613
10	5.3	0.189	0.28	3.92	0.053
11	19.8	0.051	0.08	4	0.004
Total					1.621

Effluent Exposure	40.53%
Temperature (degrees C)	10.4
Ammonia Decay	0.0955
Ammonia Exposure	**27.67%**
Dilution Ratio	**3.61**

Calculating the Exposure Concentration for a Drifting Organism in Neabsco Bay

(Temperature Data from G&H, 2005; Other information is taken directly from G&H, 1997)

Formulas Used

Effluent_Exposure = Exposure_Product / Cumulative_Exposure
Ammonia_Decay = 0.2 x 1.08 ^ (T - 20) where T = Temp in deg C
Ammonia_Exposure = Effluent_Exposure x e^(-Ammonia_Decay * Cumulative_Exposure)
Dilution_Ratio = 1 / Ammonia_Exposure

References:

Greeley and Hansen, 1997. "Near Field Mixing Analysis and Ammonia Permitting Evaluation for the H.L. Mooney Wastewater Treatment Plant"

Greeley and Hansen, 2005. "Prince William County Service Authority, H.L. Mooney Water Reclamation Facility, VPDES Permit No. VA0025101, In-Stream Monitoring Report for the Evaluation of Ammonia Effluent Limitations."

POTOMAC EMBAYMENTS
WASTELOAD ALLOCATION STUDY
FINAL REPORT, VOLUME I

Prepared for

Commonwealth of Virginia
State Water Control Board
2111 North Hamilton Street
Richmond, Virginia 23230

Prepared by

Northern Virginia Planning District Commission
7630 Little River Turnpike, Suite 400
Annandale, Virginia 22003

(Staff Technical Analysis)

With Technical Assistance Provided by
Camp Dresser & McKee

June 12, 1987

Attachment 13

POTOMAC EMBAYMENTS WASTELOAD ALLOCATION STUDY
FINAL REPORT, VOLUME I:
Study Methodology, Water Quality Goals,
and Loading and Debugging of Computer Models

EXECUTIVE SUMMARY

The initial stages of the Potomac Embayments Wasteload Allocation Study lay the groundwork for the technical analyses that are performed to develop recommended effluent limits for point source discharges to seven Virginia embayments of the Potomac Estuary. First, modeling tools to be used in the study are obtained and tested. Next, a regionally consistent methodology for wasteload allocation analysis is developed. Finally, water quality goals are developed for use as evaluation criteria in screening wasteload allocation alternatives in later stages of the study.

Embayment hydrodynamics and water quality models developed by the Virginia Institute of Marine Science (VIMS) are obtained from VIMS and loaded onto the mainframe computer system used by NVPDC. The computer codes are modified as necessary to ensure successful operation on the system. The model codes are further modified to enhance their capability and, in several cases, to correct minor errors.

The regionally consistent methodology established for the study defines the modeling approach and the general procedures for establishing design conditions, defining water quality goals, performing sensitivity studies, and completing final wasteload allocation analyses. As part of the methodology, specific data for computer model application are developed, including nonpoint loadings, Potomac main stem boundary conditions, and design values for tidal ranges, streamflows, water temperature, and solar radiation.

The water quality goals established for the study focus primarily on concentrations of dissolved oxygen and chlorophyll-a. The selected dissolved oxygen goals are the Virginia state water quality standards of 5.0 mg/L daily average and 4.0 mg/L daily minimum. Chlorophyll-a goals are developed based on the concept of no further deterioration of existing conditions, which is consistent with the State's antidegradation policy. Specific chlorophyll-a goals are established for each embayment, primarily based on computer model simulations that show the impacts of point source loadings and Potomac main stem boundary conditions on chlorophyll-a concentrations throughout the embayment.

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CONTENTS (CONTINUED)

POTOMAC EMBAYMENTS
WASTELOAD ALLOCATION STUDY
FINAL REPORT, VOLUME II

Prepared for

Commonwealth of Virginia
State Water Control Board
2111 North Hamilton Street
Richmond, Virginia 23230

Prepared by

Northern Virginia Planning District Commission
7630 Little River Turnpike, Suite 400
Annandale, Virginia 22003

(Staff Technical Analysis)

With Technical Assistance Provided by
Camp Dresser & McKee

June 12, 1987

POTOMAC EMBAYMENTS WASTELOAD ALLOCATION STUDY FINAL REPORT, VOLUME III

Prepared for

Commonwealth of Virginia
State Water Control Board
2111 North Hamilton Street
Richmond, Virginia 23230

Prepared by

Northern Virginia Planning District Commission
7630 Little River Turnpike
Annandale, Virginia 22003

(Staff Technical Analysis)

With Technical Assistance Provided by

Camp Dresser & McKee

June 30, 1988

POTOMAC EMBAYMENTS WASTELOAD ALLOCATION STUDY
FINAL REPORT, VOLUME III:

Sensitivity Studies and Final Analyses for the
Four Mile Run, Hunting Creek, and Neabsco Creek Embayments

EXECUTIVE SUMMARY

In accordance with the regionally consistent methodology presented in the Volume I final report, NVPDC and CDM conduct sensitivity studies and final analyses for the Four Mile Run, Hunting Creek, and Neabsco Creek embayments. Modeling tools developed by the Virginia Institute of Marine Science are used to predict the embayment water quality impacts of alternative treatment plant wasteloads. The modeling results are compared to water quality goals developed and presented in the Volume I final report to determine appropriate treatment plant effluent limits.

The sensitivity studies predict the extent to which embayment water quality would be affected by changes in parameters such as treatment plant loading, Potomac main stem boundary conditions, benthic flux rates, and treatment plant discharge location. After comparing the modeling results to the appropriate water quality goals, several different wasteload allocation alternatives for each embayment are selected for further analysis.

For the alternatives selected in the sensitivity studies, the final analyses include a comparison of wastewater treatment costs and of pollutant exchange between the embayment and the Potomac main stem. In addition, analyses of seasonal treatment limits for phosphorus and unoxidized nitrogen are conducted. The analysis of seasonal phosphorus removal is limited by a lack of data; as a result, no recommendations are made regarding the feasibility of seasonal phosphorus limits. The analyses for the Hunting Creek and Four Mile Run embayments incorporate the results of a recently completed Metropolitan Washington Council of Governments study of dissolved oxygen in the upper Potomac Estuary.

Based on the sensitivity studies and final analyses, the following effluent limits for dissolved oxygen (DO), 5-day carbonaceous biochemical oxygen demand (CBOD5), total Kjeldahl nitrogen (TKN), and total phosphorus (TP) are recommended for protection of embayment water quality:

EMBAYMENT	TREATMENT PLANT	PLANT FLOW (MGD)	RECOMMENDED EFFLUENT CONCENTRATION (mg/l) DO	CBOD5	TKN	TP
Four Mile Run	Arlington	40.0	6.0	10.0	---	1.00
Hunting Creek	Alexandria	54.0	7.6*	3.0	---	1.00
				-or-		
			7.6*	10.0	1.0**	1.00
Neabsco Creek	Dale City #1	4.0	6.0	10.0	---	1.00
	Dale City #8	2.0	6.0	10.0	---	1.00
	Mooney	20.0	6.0	10.0	---	1.00

*April 1 through October 31 only; limit of 6.0 mg/L November 1 through March 31

**April 1 through October 31 only; no TKN limit November 1 through March 31

To protect the main stem of the Potomac Estuary, an interim total phosphorus limit of 0.18 mg/l is regionally accepted as presented in the Interim Control Policy of the 1986 Supplement to the Metropolitan Washington 208 Plan. Therefore, at the present time, the more restrictive constraint on total phosphorus is the 0.18 mg/l limit for protection of the main stem of the Potomac. As indicated in the 208 Plan Supplement, long-term Potomac studies now under way will better define the total phosphorus limits required for protection of the Potomac main stem.

Division of Engine(.g
& Wastewater

Richard C. Thoesen, P.E., Director

Prince
am
County
Service Authority

H. L. Mooney Wastewater Treatment Plant
P.O. Box 2266 • 1851 Rippon Boulevard • Woodbridge, Virginia 22193-0266 • (703) 670-8101 • Fax (703) 590-5877

November 21, 1997

RECEIVED
NOV 21 1997
Northern VA. Region
Dept. of Env. Quality

Mr. Thomas A. Faha
Department of Environmental Quality
Northern Virginia Regional Office
13901 Crown Court
Woodbridge, Virginia 22193

Re: H. L. Mooney AWWTP - Draft VPDES Permit VA0025101

Dear Mr. Faha:

On behalf of the Service Authority, I thank you for meeting with us on November 19, 1997, to discuss our concerns with the Draft VPDES Permit. The purpose of this letter is to document our remaining concerns and to support our request that the permit be revised.

Weekly Average Ammonia

We disagree with the application of the 1.5 ratio utilized for the weekly average. Although this empirical ratio is normally used for a weekly standard, it is based on a monthly water quality standard. The ammonia nitrogen standard for the H. L. Mooney AWWTP is a voluntary standard and is technology based, not water quality based. Accordingly, the weekly standard should be water quality based and doing so will fully protect the tributary. The water quality standards are as follows:

1. The toxicity based evaluations included in the permit Fact Sheet as Attachment 13.

2. The wasteload allocation evaluations conducted for Neabsco Creek by NVPDC dated June 30, 1988 (copy attached). These studies show that the dissolved oxygen standard will be set at ammonia discharges of 20 mg/l.

Evaluation of the foregoing studies shows that toxicity and dissolved oxygen standards for ammonia as nitrogen will be met with the limits recommended in Attachment 13 as follows:

	Weekly Average - mg/l	
Parameter	18 mgd	24 mgd
Ammonia as nitrogen (April - October)	5.0	4.7

We request that these limits be included in the draft permit.

Metals Monitoring

We also discussed analyses for metals monitoring (Appendix A) during our November 19, 1997 meeting. The Service Authority's position is that only analytical methods included in 40 CFR Part 136 or approved by the USEPA Regional Administrator with the concurrence of the DEQ Director may be used. We disagree, therefore, with DEQ's intention to include unapproved 200 and 1600 series analytical methods in our VPDES permit.

We appreciate your time and consideration of our comments and the opportunity to review the draft permit.

Sincerely,

Richard C. Thoesen
Director of Engineering & Wastewater

Attachment

cc: Steve Bennett
Bob Canham
Ron Bizzarri

RCT/ls

POTOMAC EMBAYMENTS WASTELOAD ALLOCATION STUDY

FINAL REPORT, VOLUME III:

SENSITIVITY STUDIES AND FINAL ANALYSES FOR THE FOUR MILE RUN, HUNTING CREEK AND NEABSCO CREEK EMBAYMENTS

A Staff Technical Analysis

Prepared for

STATE WATER CONTROL BOARD

Prepared by

NORTHERN VIRGINIA PLANNING DISTRICT COMMISSION

with Technical Assistance Provided by

CAMP DRESSER & McKEE

JUNE 30, 1988

10.0 FINAL WLA ALTERNATIVE ANALYSIS FOR NEABSCO CREEK

10.1 EMBAYMENT DESIGN CONDITIONS

In addition to the established low flow and high temperature design conditions, three other conditions are set for the final analysis of the WLA alternatives. They include: Potomac Estuary boundary conditions, benthic flux rates, and discharge location.

Changes to the Potomac Estuary boundary chlorophyll-a concentration from 80 ug/L (design conditions) to 100 and 50 ug/L did not significantly impact the daily minimum or minimum daily average DO concentrations which occurred for the most part in the uppermost segments of Neabsco Creek. These changes were analyzed with the Interim Control Decision with and without nitrification. The 80 ug/L chlorophyll-a goal for the downstream zone is violated only when a Potomac Estuary boundary of 100 ug/L is assumed, and the violation occurs regardless of the total phosphorus effluent concentration for the three WWTPs that discharge to Neabsco Creek. The chlorophyll-a goal of 30 ug/L in the upstream zone 2 is not exceeded for the increased boundary condition of 100 ug/L. Therefore, the design chlorophyll-a boundary concentration of 80 ug/L at the Potomac Estuary is used for the final analysis.

Benthic flux rates for ammonia and SOD were analyzed for $\pm$ 30 percent of the calibrated values. The embayment response of dissolved oxygen concentrations was not sensitive to these changes in benthic flux rates and thus the calibrated rates are used in the final analysis.

The sensitivity of the embayment water quality to different treatment plant locations was performed for the Mooney treatment plant. Different locations for the Dale City treatment plants were not analyzed. The analysis showed that the upstream discharge location reduced the daily minimum and minimum daily average dissolved oxygen concentrations below the values at the present discharge location. At the upstream location the daily average dissolved oxygen standard was violated. The minimum dissolved oxygen values at the downstream location were similar to the values at the present discharge location. Therefore, the final analysis includes wasteload allocation investigations at the present discharge location for the Mooney wastewater treatment plant.

In summary, the final alternatives are analyzed with the design Potomac Estuary boundary condition, calibrated benthic flux rates and at the present discharge location.

10.2 WLA ALTERNATIVES

The wasteload allocation alternatives include the following:

1. Interim Control Decision without nitrification (TP = 0.18 mg/L), and

2. Interim Control Decision without nitrification with an effluent total phosphorus of 1.0 mg/L.

Alternatives 1 and 2 are selected based on the results of the sensitivity study. Table 10-1 presents the effluent concentrations for the two WLA alternatives. The alternatives only differ in the total phosphorus concentrations which are presented in the table as organic phosphorus and orthophosphorus.

The impact of the two wasteload allocation alternatives on the dissolved oxygen and chlorophyll-a in the embayment are presented in Table 10-2. The state's dissolved oxygen standards and the chlorophyll-a goals established as part of this study are met by both alternatives. At a discharge of 20.0 mgd for Mooney and 6.0 mgd for the two Dale City plants combined, the minimum daily average DO is 5.3 mg/L and the daily minimum DO is 4.6 mg/L for both alternatives. The Interim Control Decision alternatives are modeled with a CBOD5 of 10.0 mg/L, ammonia of 20.0 mg/L and dissolved oxygen of 6.0 mg/L.

TABLE 10-1

EFFLUENT CONCENTRATIONS OF WLA ALTERNATIVES

WLA Alternatives	Q (mgd)	Effluent Concentration (mg/L) Org. N	NH3	NO2+ NO3	Org. P	Ortho-P	CBOD5	DO
MOONEY, DALE CITY 1 AND 8[1] (Neabsco Creek)								
1. Interim Control Decision Without Nitrification (TP = 0.18 mg/L)								
Mooney	20.0	0.0	20.0	0.0	0.02	0.16	10.0	6.0
Dale City 1 and 8	6.0	0.0	20.0	0.0	0.02	0.16	10.0	6.0
2. Interim Control Decision Without Nitrification with TP = 1.0 mg/L								
Mooney	20.0	0.0	20.0	0.0	0.10	0.90	10.0	6.0
Dale City 1 and 8	6.0	0.0	20.0	0.0	0.10	0.90	10.0	6.0

[1] With design Potomac Estuary boundary conditions, calibrated benthic flux rates and at existing discharge locations.

TABLE 10-2

NEABSCO CREEK
WATER QUALITY MODEL PROJECTIONS FOR WLA ALTERNATIVES

WLA Alternative	DO (mg/l) Daily Minimum	DO (mg/l) Min. Daily Avg.	CHLA (ug/l) Zone 1 Max. Daily Avg.	CHLA (ug/l) Zone 2 Max. Daily Avg.
1. Interim Control Decision Without Nitrification (TP=0.18 mg/L)	4.6(5)[1]	5.3(2)	75(10)	17(5)
2. Interim Control Decision Without Nitrification and TP=1.0 mg/L	4.6(5)	5.3(2)	76(10)	18(5)

[1]Numbers in parenthesis denote location of constituent concentration by model segment.

The maximum daily average chlorophyll-a concentrations in the downstream zone 1 are dominated by the Potomac main stem boundary condition of 80 ug/L. The different alternative phosphorus concentrations in the plant discharge do not have a significant impact on the chlorophyll-a concentrations in the downstream reaches. For an increase of total phosphorus from 0.18 mg/L to 1.0 mg/L, the maximum daily average chlorophyll-a of zone 1 increases from 75 ug/L to 76 ug/L. These values are below the 80 ug/L chlorophyll-a goal for zone 1. In the upstream zone 2, the increase in total phosphorus from alternative number 1 to alternative number 2 only increases the maximum daily average chlorophyll-a from 17 ug/L to 18 ug/L. These concentrations are below the 30 ug/L chlorophyll-a limit established for zone 2.

10.3 POLLUTANT FLUX TO THE POTOMAC MAIN STEM

The net fluxes of ammonia, BOD and total phosphorus from the embayment to the Potomac main stem are determined for the WLA alternatives. For each of the three constituents Table 10-3 presents the WWTP load, the net flux due to the WWTP and the percent of the WWTP load exported to the Potomac. For both alternatives about 90 percent of the WWTP ammonia load is exported to the Potomac main stem, and almost 50 percent of the WWTP CBODU load is exported. For the two different total phosphorus loads (TP=0.18 mg/L for alternative number 1 and TP=1.0 mg/L for alternative number 2) the amount of the WWTP load exported to the Potomac main stem is about 45 percent.

10.4 SEASONAL NITRIFICATION

Under the summer design conditions, nitrification was not required for the Mooney and the two Dale City wastewater treatment plants to meet the State's dissolved oxygen standards for Neabsco Creek. Therefore, an evaluation of seasonal nitrification is not required.

TABLE 10-3

NEABSCO CREEK
POTOMAC MAIN STEM FLUX PROJECTIONS FOR WLA ALTERNATIVES

Constituent	WWTP Load (mg/L)	WWTP Load (kg/day)	Net Flux Due to WWTP (kg/day)	Percent of WWTP Load to Potomac
Ammonia-N (Without Nitrification)	19.2[1]	1,890	1,730	91
CBODU (CBOD5 = 10.0 MG/L)	26.2[1]	2,580	1,220	47
Total Phosphorus (0.18 mg/L)	0.18	18	8.4	47
Total Phosphorus (1.0 mg/L)	1.0	99	40.9	42

[1]WWTP load values reflect ammonia and BOD decay for Dale City WWTP's and thus are slightly less than the normal 20.0 mg/L for ammonia and 27.0 mg/L for CBODU

10.5 SEASONAL PHOSPHORUS REMOVAL

The potential for phosphorus accumulation within the embayments during months when stringent treatment standards are not imposed is evaluated for the Mooney and Dale City WWTPs. A specific methodology has been developed to consider winter accumulation and summer release of phosphorus from the benthos for the point source contribution only. The overall approach assumes that the WWTP phosphorus which settles out during the winter months is released back into the water column during the summer months at the same rate. Studies have shown that phosphorus can accumulate for several years and then can be released at a high rate during special conditions. To predict long term settling and periodic release is beyond the scope of this study. Therefore the daily accumulation of phosphorus is translated to a release rate which is applied to the low flow, high temperature, design conditions. The analysis is conducted using the calibrated model and does not consider extreme events such as anoxic conditions or very low pH which may release more phosphorus than under normal equilibrium conditions. The calibrated Neabsco Creek model has organic P and ortho-P settling rates but does not have calibrated benthic organic P nor ortho-P release rates.

The design condition for this analysis includes an average annual inflow rate for the headwater and incremental flows during the winter time simulation. For this simulation the dissolved oxygen of the upstream and Potomac Estuary boundaries is set at 9.2 mg/L, one mg/L less than saturation at the design temperature of 15 C. The winter time analysis does not include the simulation of algae.

In order to determine the effect of relaxing a more stringent total phosphorus allocation to a less stringent concentration in the winter months, two wasteload scenarios are selected for the analysis which includes a TP = 0.18 mg/L and a TP = 1.0 mg/L for the Interim Control Decision without nitrification. The following approach is conducted. First, the TP = 0.18 mg/L is considered a base line case. The effluent organic phosphorus and orthophosphorus load for the TP = 0.18 mg/L case is subtracted from the corresponding loads for the TP = 1.0 mg/L case to demonstrate the differential load between the two effluent cases. The total fluxes of the organic P and ortho-P to the Potomac Estuary are calculated for the two cases and the differences are computed to produce the differential load exported to the Potomac Estuary. Now, the difference of these differential loads (treatment plant effluent and flux) is the amount of phosphorus accumulated in the embayment from settling due to the treatment plant discharge of 1.0 mg/L where 0.18 mg/L is considered the base case.

For the Mooney and Dale City WWTPs, the incremental organic P and ortho-P are 8.1 kg/d and 72.7 kg/d, respectively. The incremental organic P and ortho-P fluxes to the Potomac are 3.6 kg/d and 38.0 kg/d, respectively. Therefore, the incremental phosphorus accumulation is 4.5 kg/d for organic P and 34.7 kg/d for ortho-P.

The organic P and ortho-P accumulation rates are then applied to the model during the summer time design condition as release rates. The benthic phosphorus release rates are distributed to reaches 2 through 11 in proportion to the SOD rates which are used to indicate the distribution of settled constituents from the treatment plant discharges.

Two cases are considered. For the first, the accumulated organic P and ortho-P are both released separately as $g/m^2/day$ in the model. The organic P release rate is 0.003 $g/m^2/day$, and the ortho-P release rate is 0.023 $g/m^2/day$. A maximum average daily chlorophyll-a concentration of 76 ug/L occurs in the downstream zone 1. In the upstream zone 2, 18 ug/L is predicted to occur during the summer with the additional benthic phosphorus releases.

For the second and more conservative case, the winter accumulated organic P and ortho-P are released as all ortho-P during the summer. The release rate is 0.026 $g/m^2/day$. The maximum daily average chlorophyll-a concentrations in zone 1 (76 ug/L) and zone 2 (18 ug/L) are the same as those for the first case. These maximum daily average chlorophyll-a concentrations with the additional phosphorus releases are only 1 ug/L greater than the chlorophyll-a concentration produced without the estimated increase.

10.7 RECOMMENDED WASTELOAD ALLOCATION

Rationale for a WQ-based Weekly Avg Max limit Apr-Oct

The State's dissolved oxygen standards are not predicted to be violated for a CBOD5 of 10.0 mg/l and an $\boxed{\text{ammonia concentration of 20.0 mg/L}}$. Therefore the Interim Control Decision with a CBOD5 of 10.0 mg/L and without nitrification is recommended. A total phosphorus effluent concentration of 1.0 mg/L is not predicted to violate the chlorophyll-a goal of 80 ug/L in Zone 1 and 30 ug/L in Zone 2.

In order to meet the State's dissolved oxygen standard and the embayment's chlorophyll-a management goals, the recommended effluent limits for a 20 mgd discharge for the H.L. Mooney WWTP, a 4 mgd discharge for the Dale City plant #1 and a 2 mgd discharge for the Dale City plant #8 are as follows:

Constituent	Effluent Limit
Dissolved Oxygen (DO)	6.0 mg/L year-round
5-day Carbonaceous Biochemical Oxygen Demand (CBOD5)	10.0 mg/L year-round
Total Kjeldahl Nitrogen (TKN)	No nitrification required
Total Phosphorus (TP)	1.0 mg/L*

Within the embayment, the chlorophyll-a goals are not predicted to be violated for an effluent total phosphorus concentration of 1.0 mg/L. To protect the main stem of the Potomac Estuary, an interim total phosphorus limit of 0.18 mg/L is regionally accepted as presented in the Interim Control Policy of the 1986 208 Plan Supplement (Wash. COG, 1986). Therefore, at the present time, the more restrictive limit on total phosphorus is the 0.18 mg/L for protection of the main stem Potomac. As indicated in the 208 Plan Supplement, future long-term Potomac Studies being mutually undertaken by COG, the states and EPA will better define the total phosphorus limits required for Potomac main stem protection.

---

*The effluent limit is based on the simulation of the low-flow, high-temperature design conditions. Future studies that evaluate effluent constraints for the main stem of the Potomac will consider the feasibility of seasonal phosphorus removal standards.

5/8/2014 7:31:47 AM

Facility = HL Mooney
Chemical = Ammonia (Nov-January)
Chronic averaging period = 30
WLAa = 31.62
WLAc = 11.05
Q.L. = .2
# samples/mo. = 30
# samples/wk. = 8

Summary of Statistics:

observations = 1
Expected Value = 9
Variance = 29.16
C.V. = 0.6
97th percentile daily values = 21.9007
97th percentile 4 day average = 14.9741
97th percentile 30 day average= 10.8544
< Q.L. = 0
Model used = BPJ Assumptions, type 2 data

No Limit is required for this material

The data are:

9

5/8/2014 7:34:01 AM

Facility = HL Mooney
Chemical = Ammonia (February-March)
Chronic averaging period = 30
WLAa = 13.5
WLAc = 4.51
Q.L. = .2
# samples/mo. = 30
# samples/wk. = 8

Summary of Statistics:

observations = 1
Expected Value = 9
Variance = 29.16
C.V. = 0.6
97th percentile daily values = 21.9007
97th percentile 4 day average = 14.9741
97th percentile 30 day average= 10.8544
< Q.L. = 0
Model used = BPJ Assumptions, type 2 data

A limit is needed based on Chronic Toxicity
Maximum Daily Limit = 9.09969212130756
Average Weekly limit = 5.42801263050433
Average Monthly LImit = 4.51

The data are:

9

5/8/2014 7:57:31 AM

Facility = HL Mooney
Chemical = Ammonia (Feb - March) using MSTRANTI from 2009
Chronic averaging period = 30
WLAa = 13.357
WLAc = 4.332
Q.L. = .2
# samples/mo. = 30
# samples/wk. = 8

Note: MSTRANTI WLAs are only 2 significant figures so the Facility's WLAs (calculated with the dilution factor) are lower.

Summary of Statistics:

observations = 1
Expected Value = 9
Variance = 29.16
C.V. = 0.6
97th percentile daily values = 21.9007
97th percentile 4 day average = 14.9741
97th percentile 30 day average= 10.8544
< Q.L. = 0
Model used = BPJ Assumptions, type 2 data

A limit is needed based on Chronic Toxicity
Maximum Daily Limit = 8.74054684467946
Average Weekly limit = 5.21378064641791
Average Monthly LImit = 4.332

The data are:

9

7/2/2014 12:44:44 PM

Facility = HL Mooney
Chemical = Ammonia as N (Apr-Oct)
Chronic averaging period = 30
WLAa = 7.74
WLAc = 3.42
Q.L. = .2
# samples/mo. = 30
# samples/wk. = 8

Summary of Statistics:

observations = 1
Expected Value = 9
Variance = 29.16
C.V. = 0.6
97th percentile daily values = 21.9007
97th percentile 4 day average = 14.9741
97th percentile 30 day average= 10.8544
< Q.L. = 0
Model used = BPJ Assumptions, type 2 data

A limit is needed based on Chronic Toxicity
Maximum Daily Limit = 6.90043171948378
Average Weekly limit = 4.11614261559309
Average Monthly LImit = 3.42

The data are:

9

5/1/2014 10:07:42 AM

Facility = H.L. Mooney
Chemical = Toxicity - P. promelas
Chronic averaging period = 4
WLAa = 6
WLAc = 2.39
Q.L. = 1
# samples/mo. = 1
# samples/wk. = 1

Summary of Statistics:

observations = 12
Expected Value = 1
Variance = 0
C.V. = 0
97th percentile daily values = 1
97th percentile 4 day average = 1
97th percentile 30 day average= 1
< Q.L. = 0
Model used = lognormal

No Limit is required for this material

The data are:

1
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5/1/2014 10:06:57 AM

Facility = H.L. Mooney
Chemical = Toxicity - C. dubia
Chronic averaging period = 4
WLAa = 6
WLAc = 2.39
Q.L. = 1
# samples/mo. = 1
# samples/wk. = 1

Summary of Statistics:

observations = 12
Expected Value = 1
Variance = 0
C.V. = 0
97th percentile daily values = 1
97th percentile 4 day average = 1
97th percentile 30 day average= 1
< Q.L. = 0
Model used = lognormal

No Limit is required for this material

The data are:

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MEMORANDUM

DEPARTMENT OF ENVIRONMENTAL QUALITY
Northern Regional Office
13901 Crown Court **Woodbridge, VA 22193** **(703) 583-3800**

SUBJECT: TOXICS MANAGEMENT PROGRAM (TMP) DATA REVIEW
H.L. Mooney Wastewater Treatment Works (VA0025101)
REVIEWER: Douglas Frasier
DATE: 12 November 2013

PREVIOUS REVIEW: 12 October 2012

DATA REVIEWED:

This review covers the second (2nd) annual acute and chronic toxicity tests conducted in August 2013 at Outfall 001.

DISCUSSION:

The results of these toxicity tests, along with the results of previous toxicity tests conducted since 1998 on effluent samples collected from Outfall 001, are summarized in Table 1.

The acute toxicity of the effluent sample was determined with a static 48-hour acute toxicity test using *C. dubia* and *P. promelas* as the test species. The acute test yielded for both species a No Observed Adverse Effect Concentration (NOAEC) of 100% effluent; thus passing the acute toxicity criterion.

The chronic toxicity of the effluent samples was determined with a static daily renewal 3-brood survival and reproduction test using *C. dubia* and a static daily renewal 7-day survival and growth test using *P. promelas*. Both toxicity tests yielded a No Observed Effect Concentration (NOEC) of 100% effluent; passing the chronic toxicity criteria.

CONCLUSIONS:

The acute and chronic toxicity tests are valid and the results are acceptable. The test results indicate that the effluent samples exhibit no acute or chronic toxicity for the test species.

BIOMONITORING RESULTS

H.L. Mooney Wastewater Treatment Works (VA0025101)

Table 1
Summary of Toxicity Test Results for Outfall 001

TEST DATE	TEST TYPE/ORGANISM	48-h LC_{50} (%)	IC_{25} (%)	NOAEC /NOEC (%)	% SURV	TU_a	TU_c	REMARKS
6/25/98	Acute *C. dubia*	**66.6**			5			1st quarterly
6/25/98	Acute *P. promelas*	>100			100			
6/23/98	Chronic *C. dubia*			**10 SR**	0			
6/23/98	Chronic *P. promelas*			100 SG	90			
11/5/98	Acute *C. dubia*	>100			100			2nd quarterly
11/5/98	Acute *P. promelas*	>100			100			
11/3/98	Chronic *C. dubia*			100 SR	100			
11/3/98	Chronic *P. promelas*			100 SG	100			
3/23/99	Acute *C. dubia*	>100			100			3rd quarterly
3/23/99	Acute *P. promelas*	>100			100			
3/20/99	Chronic *C. dubia*			100 SR	100			
3/20/99	Chronic *P. promelas*			100 SG	100			
6/29/99	Acute *C. dubia*	>100			100			4th quarterly
6/29/99	Acute *P. promelas*	>100			95			
6/24/99	Chronic *C. dubia*			100 SR	100			
6/24/99	Chronic *P. promelas*			100 SG	95			
11/9/99	Acute *C. dubia*	>100			100			1st annual
11/4/99	Chronic *C. dubia*			**Invalid**				30% mortality in control group
11/18/99	Chronic *C. dubia*			100 SR	100			Retest
10/31/00	Acute *C. dubia*	>100			100			2nd annual
10/31/00	Acute *P. promelas*	>100			100			
10/26/00	Chronic *C. dubia*			100 SR	90			
10/26/00	Chronic *P. promelas*			100 SG	98			
08/28/01	Acute *C. dubia*	**85.5**			40			3rd annual
08/28/01	Acute *P. promelas*	>100			100			
08/23/01	Chronic *C. dubia*	>100	77.8	100 S 39.17 R	90			
08/23/01	Chronic *P. promelas*	>100	>100	100 SG	98			
10/16/01	Acute *C. dubia*	>100			100			Retest
10/16/01	Acute *P. promelas*	>100			100			
10/13/01	Chronic *C. dubia*	>100	>100	100 SR	100			
10/11/01	Chronic *P. promelas*	>100	>100	100 SG	100			3 minnows lost in test
08/27/02	Acute *C. dubia*	>100			100			4th annual
08/27/02	Acute *P. promelas*	>100			95			

TEST DATE	TEST TYPE/ORGANISM	48-h LC_{50} (%)	IC_{25} (%)	NOAEC /NOEC (%)	% SURV	TU_a	TU_c	REMARKS
08/22/02	Chronic *C. dubia*	>100	>100	100 SR	50			Control survival 80%
08/22/02	Chronic *P. promelas*	>100	>100	100 SG	88			
07/24/03	Acute *C. dubia*	>100			100			5th annual
07/24/03	Acute *P. promelas*	>100			100			
07/22/03	Chronic *C. dubia*	>100	>100	100 SR	90			
07/22/03	Chronic *P. promelas*	>100	>100	100 SG	100			
Permit Reissued October 15, 2003								
11/20/03	Acute *C. dubia*	>100		100	85	1		1st annual
11/20/03	Acute *P. promelas*	>100		100	100	1		
11/18/03	Chronic *C. dubia*	>100	>100	100 SR	100		1	
11/18/03	Chronic *P. promelas*	>100	>100	100 SG	100		1	
04/14/05	Acute *C. dubia*	>100		100	100	1		2nd annual
04/14/05	Acute *P. promelas*	>100		100	100	1		
04/12/05	Chronic *C. dubia*	>100	>100	100 SR	100		1	
04/12/05	Chronic *P. promelas*	>100	58	1 SG	68		100	
06/21/05	Acute *P. promelas*	>100		100	100	1		3rd annual
06/21/05	Acute *P. promelas*	>100		100	100	1		
06/16/05	Chronic *C. dubia*	>100	>100	100 SR	100		1	
06/16/05	Chronic *P. promelas*	>100	>100	100 SG	100		1	
06/13/06	Acute *C. dubia*	>100		100	100	1		
06/13/06	Acute *P. promelas*	>100		100	100	1		
06/08/06	Acute *C. dubia*							INVALID
06/08/06	Chronic *P. promelas*	>100	>100	100 SG	100		1	
08/16/07	Acute *C. dubia*	>100		100	100	1		4th annual
08/16/07	Acute *P. promelas*	>100		100	100	1		
08/14/07	Chronic *C. dubia*	>100	>100	100 SR	100		1	
08/14/07	Chronic *P. promelas*	>100	>100	100 SG	100		1	
02/14/08	Acute *C. dubia*	>100		100	100	1		
02/14/08	Acute *P. promelas*	>100		100	100	1		
02/12/08	Chronic *C. dubia*	>100	>100	100 SR	100		1	
02/12/08	Chronic *P. promelas*	>100	>100	100 SG	98		1	
08/07/08	Acute *C. dubia*	>100		100	100	1		5th annual
08/07/08	Acute *P. promelas*	>100		100	100	1		
08/05/08	Chronic *C. dubia*	>100	>100	100 SR	100		1	80% survival for control
08/05/08	Chronic *P. promelas*	>100	>100	100 SG	93		1	
Permit Reissued 1 July 2009								
09/24/09	Acute *C. dubia*	>100		100	95	1		1st annual
09/24/09	Acute *P. promelas*	>100		100	100	1		

TEST DATE	TEST TYPE/ORGANISM	48-h LC_{50} (%)	IC_{25} (%)	NOAEC /NOEC (%)	% SURV	TU_a	TU_c	REMARKS
09/22/09	Chronic *C. dubia*	>100	>100	100 S **10 R**	100		10	
09/22/09	Chronic *P. promelas*	>100	>100	100 SG	98		1	
CTO Issued for the 24 MGD Plant 8 November 2010								
11/02/10	Acute *C. dubia*	>100		100	100	1		1st quarter
11/02/10	Acute *P. promelas*	>100		100	100	1		
10/28/10	Chronic *C. dubia*	>100	>100	100 SR	100		1	
10/28/10	Chronic *P. promelas*	>100	>100	100 SG	100		1	
04/19/11	Acute *C. dubia*	>100		100	100	1		2nd quarter
04/28/11	Acute *P. promelas*	>100		100	100	1		
04/14/11	Chronic *C. dubia*	>100	>100	100 SR	100		1	
04/14/11	Chronic *P. promelas*	>100	>100	100 SG	98		1	
06/23/11	Acute *C. dubia*	>100		100	100	1		3rd quarter
06/23/11	Acute *P. promelas*	>100		100	100	1		
06/21/11	Chronic *C. dubia*	>100	>100	100 SR	100		1	
06/21/11	Chronic *P. promelas*	>100	>100	100 SG	98		1	
12/08/11	Acute *C. dubia*	>100		100	95	1		4th quarter
12/08/11	Acute *P. promelas*	>100		100	100	1		
12/06/11	Chronic *C. dubia*	>100	>100	100 SR	100		1	
12/06/11	Chronic *P. promelas*	>100	>100	100 SG	100		1	
08/02/12	Acute *C. dubia*	>100		100	100	1		1st annual
08/02/12	Acute *P. promelas*	>100		100	100	1		
07/31/12	Chronic *C. dubia*	>100	>100	100 SR	100		1	
07/31/12	Chronic *P. promelas*	>100	>100	100 SG	98		1	
08/22/13	Acute *C. dubia*	>100		100	90	1		2nd annual
08/22/13	Acute *P. promelas*	>100		100	100	1		
08/20/13	Chronic *C. dubia*	>100	>100	100 SR	100		1	
08/20/13	Chronic *P. promelas*	>100	>100	100 SG	95		1	

FOOTNOTES:

A **bold** faced value for LC_{50} or NOEC indicates that the test failed the criteria.

ABBREVIATIONS:

S - Survival; R - Reproduction; G - Growth
% SURV – Percent survival in 100% effluent
EA - EA Engineering, Science, and Technology, Inc.

Jan-Dec 2012		January-12	February-12	March-12	April-12	May-12	June-12	July-12
As	Arsenic	28.2	29.1	24.7	<10.0	27.7	30.7	<4.00
Be	Beryllium	0.61	0.65	0.38	0.53	<0.20	<0.20	0.29
Cd	Cadmium	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Cr	Chromium	21.7	25.3	21.4	28.1	20.1	24.2	21.4
Cu	Copper	108	111	83.9	165	144	158	145
Pb	Lead	16.6	11.6	9.50	12.1	8.80	7.48	9.15
Hg	Mercury	0.23	0.27	0.20	0.15	0.40	0.41	0.28
Mo	Molybdenum	<4.0	7.01	<4.00	5.42	4.88	5.41	4.10
Ni	Nickel	6.12	5.66	4.93	5.90	5.78	6.43	6.36
Se	Selenium	<4.0	19.0	<4.0	<4.0	<4.0	<4.0	<4.00
Zn	Zinc	315	324	251	345	356	394	373
Fe	Iron							
V*								
%TS	Total Solids						27.70%	28.10%

As	Arsenic	August-12	September-12	October-12	Nov 2012	Dec 12
Be	Beryllium					
Cd	Cadmium	<20.0	19.4	<11.0	<11.0	14
Cr	Chromium	<0.400	0.262	<0.20	<0.20	<0.40
Cu	Copper	<2.0	<2.0	<1.9	2.3	2.4
Pb	Lead	13.5	15.1	14	15	21
Hg	Mercury	112	156	127	121	124
Mo	Molybdenum	<20.0	11.9	17	21	23
Ni	Nickel	<0.0250	0.222	0.69	0.31	0.40
Se	Selenium	4.16	5.38	7	9	17
Zn	Zinc	5.56	7.04	8	9	8
Fe	Iron	<20.0	<10.0*	4.4	4.4	5.7
V*	Vanadium	339	434	422	385	401
Fe	Iron			27200	27000	30200
%TS	Total Solids	24.80%	28.40%	26.40%	26.60%	27.00%

** All units are mg/kg

* Sample reanalyzed by HRSD

Result= 4.3

Attachment 16

Sludge Cake Analyis 2013

		January	February	March	April	May	June	July	August	Sept
Collection Date:		01/07/13	02/06/13	03/11/13	04/09/13	05/07/13	06/07/13	07/11/13	08/01/13	09/04/13
As	Arsenic	<12	<12	<11	<11	<12	<11	4.0	3.0	4.0
Be	Beryllium	0.311	0.277	0.266	<0.200	<0.200	0.703	<0.2000	<0.2000	<0.2000
Cd	Cadmium	<1.9	2.4	2.2	1.8	<2.0	<1.8	<2.0	<2.0	<2.0
Cr	Chromium	20	23	26	22	22	32	35	36	40
Cu	Copper	100	109	88	93	96	166	159	137	171
Pb	Lead	19	26	28	21.0	15	19	15	13	14
Hg	Mercury	0.32	0.24	0.17	0.23	0.23	0.49	0.40	0.5	0.5
Mo	Molybdenum	13	15	14	11	14	17	<5	<5	<5
Ni	Nickel	6	7	7	5	6	8	8	8	10
Se	Selenium	5.5	5.6	3.5	4.6	4.9	3.2	<5.0	<5.0	5.0
Zn	Zinc	370	375	361	330	344	459	546	532	526
Fe	Iron	29300	30100	32700	25700	26600	32500	38800	++++	++++
V*	Vanadium	-----	7.66	8.40	9.10	7.12	8.86	8.91	9.10	5.34
	Total Solids	26.80%	24.70%	26.70%	27.30%	24.80%	28.1%	27.00%	25.25%	26.90%

*** Began analyzing monthly 2/13 at Analytics Corporation**

**** All units are mg/kg**

***** Beryllium analyzed at Analytics Corporation**

****** All other metals analyzed at HRSD**

Nickel reanalyzed by HRSD. Originally reported 121 mg/kg

++++ Analyzed Iron per request of Steve Bennet, ceased analysis 8/13

Beginning in July 2013 All metals with the exception of Be and V were analyed at A&L Laboratories

Public Notice – Environmental Permit

PURPOSE OF NOTICE: To seek public comment on a draft permit from the Department of Environmental Quality that will allow the release of treated wastewater into a water body in Prince William, Virginia.

PUBLIC COMMENT PERIOD: XXX, 2014 to XXX, 2014

PERMIT NAME: Virginia Pollutant Discharge Elimination System Permit – Wastewater issued by DEQ, under the authority of the State Water Control Board

APPLICANT NAME, ADDRESS AND PERMIT NUMBER: Prince William County Service Authority, PO Box 2266, Woodbridge, VA 22195, VA0025101

NAME AND ADDRESS OF FACILITY: HL Mooney Advanced Water Reclamation Facility, 1851 Rippon Blvd, Woodbridge, VA 22191

PROJECT DESCRIPTION: NAME OF APPLICANT has applied for a reissuance of a permit for the public HL Mooney Advanced Water Reclamation Facility. The applicant proposes to release treated sewage wastewaters from residential and commercial areas at a rate of 24 million gallons per day into a water body. The sludge will be disposed by one of the following methods: incineration, disposal at an approved landfill, land application by an approved contractor, or composting at a permitted facility. The facility proposes to release the treated sewage in the Neabsco Creek in Prince William County in the Potomac watershed. A watershed is the land area drained by a river and its incoming streams. The permit will limit the following pollutants to amounts that protect water quality: pH, cBOD, Total Suspended Solids, Total Nitrogen, *E. coli*, Ammonia as N, Dissolved Oxygen, and Total Phosphorus, The facility shall also monitor without limitation the following parameters: Total Kjeldahl Nitrogen, Nitrate+Nitrite, and Whole Effluent Toxicity.

This facility is subject to the requirements of 9VAC25-820 and has registered for coverage under the General VPDES Watershed Permit Regulation for Total Nitrogen and Total Phosphorus Discharges and Nutrient Trading in the Chesapeake Watershed in Virginia.

HOW TO COMMENT AND/OR REQUEST A PUBLIC HEARING: DEQ accepts comments and requests for public hearing by hand-delivery, e-mail, fax or postal mail. All comments and requests must be in writing and be received by DEQ during the comment period. Submittals must include the names, mailing addresses and telephone numbers of the commenter/requester and of all persons represented by the commenter/requester. A request for public hearing must also include: 1) The reason why a public hearing is requested. 2) A brief, informal statement regarding the nature and extent of the interest of the requester or of those represented by the requester, including how and to what extent such interest would be directly and adversely affected by the permit. 3) Specific references, where possible, to terms and conditions of the permit with suggested revisions. A public hearing may be held, including another comment period, if public response is significant, based on individual requests for a public hearing, and there are substantial, disputed issues relevant to the permit.

CONTACT FOR PUBLIC COMMENTS, DOCUMENT REQUESTS AND ADDITIONAL INFORMATION: The public may review the draft permit and application at the DEQ-Northern Regional Office by appointment, or may request electronic copies of the draft permit and fact sheet.
Name: Alison Thompson
Address: DEQ-Northern Regional Office, 13901 Crown Court, Woodbridge, VA 22193
Phone: (703) 583-3834 E-mail: Alison.Thompson@deq.virginia.gov Fax: (703) 583-3821